RAILROAD GAZETTE

FRIDAY, OCTOBER 2, 1903.

CONTENTS

Contributions

A Despatcher's Puzzle.

Illinois Central Railroad,
Louisville, Ky., Aug. 17, 1903.

To the Editor of The Railroad Gazette:

I hand you herewith for your decision a train order which has given rise to considerable discussion. There is a wide difference of opinion respecting the responsibility of the crew on second No. 2.

For convenience we will select the cities of Louisville, Indianapolis and St. Louis. Westbound trains (even numbers) are superior to eastbound trains of the same class. First and second No. 2 receive the following order: "First No. 2 will wait at Indianapolis until 1.30 a.m. for first, second and third No. 1." The despatcher finds that third No. 1 will not be able to reach Indianapolis in season and issues the following order: "To C. and E. first and second No. 2, Louisville and to C. and E. third No. 1, St. Louis; first No. 2 will meet third No. 1 at Indianapolis." First No. 2 reaches Indianapolis, forgets the meet order and goes on. Second No. 2 arriving at Indianapolis and not finding third No. 1, but seeing first No. 2 has left leaves also against third No. 1.

The question is, does the order addressed to first and second No. 2, reading "First No. 2 will meet third No. 1 at Indianapolis" require second No. 2 to actually meet this train at Indianapolis, or has second No. 2 a right to follow the signals of first No. 2.

E. F. NORTH, *Chief Despatcher.*

[As second number two has all the rights, privileges and immunities of first number two, even to the privilege of jumping off a precipice if opportunity should offer, the conductor and engineman of second No. 2 decided, no doubt, that they had strong justification for their action in going on from Indianapolis; but this conclusion was clouded by two doubts; and as even one doubt should deter them from proceeding, the superintendent can justly decide that they did wrong. The first doubt is, Why was the meeting order sent to second No. 2? And why did the despatcher specify first No. 2, when the order necessarily affected second No. 2 equally? The second doubt is, Where was third No. 1? As the names of stations given by Mr. North are evidently fictitious, all sorts of local conditions may be concealed in what he does not tell us; but this doubt is sufficient warrant for either the conductor or the engineman in refusing to proceed.—Editor.]

The Production and Distribution of Alternating Current for Large City Systems.*

The great and all-important question which confronts the manager and which the engineer should assist him in solving, is how to transport passengers with the greatest degree of safety, reliability and economy. The power plant and transmission system constitute only two links in the chain of many devices necessary to accomplish this task, and should not be given undue importance in the laying out of the general scheme. Economy of generation or transmission of power should never be sought after at the expense of safety or reliability of operation. More important than the question of how to generate and transmit alternating current, is whether or not to generate it at all.

In this paper the alternating current will be considered to be made by steam power at a central station, transmitted at a high voltage to sub-stations located in different parts of the territory to be served, there converted into 575-volt direct current and distributed by means of feeders to the trolley sections in the usual way.

Site of Station.—The central station should be where coal may be obtained by rail or water, or both, and where large quantities of water may be obtained for condensing purposes. If a location fulfilling these requirements may be obtained in any large city near the center of gravity of the load, well and good; if not, it is not so serious as it would be if the plant were designed to furnish direct current. The location should not be in a residence district where the plant is apt to become a nuisance, and physical obstacles to the laying of feeder mains, such as rivers, bridges, etc., should be avoided if possible.

Coal Supply.—It is preferable that coal should be delivered crushed ready for the automatic stokers, but provision should be made in the lay-out of the station for a coal crushing plant to handle lump and mine run coal. The quantity of coal burned in the large stations is such that if an attempt is made to furnish storage capacity within the plant for even a short period of time, the size and cost of the building is greatly increased by the large coal tank above the boilers. It is better to carry only a few days' supply in the tank in the boiler room, and provide a separate building for the coal reserve, connected by conveyors to the boiler room, where the coal may be kept nearer the ground, and the cost of the iron work for its storage diminished. It pays to devote a great deal of attention to what is really the most economical coal to burn, and not to assume, as is often done, that that coal is the best which can be had for the lowest price per ton.

Building.—The power plant building should be substantial and fireproof and just as ornate as the directors of the company wish to authorize. The plant should be entirely closed and should be built so that all employees and visitors enter by one door and be checked in and out. Conveniences should be arranged so that if necessary the entire operating force can be lodged and fed in the building.

Coal and Ash Handling Machinery.—It is better in a large installation to keep coal and ash handling apparatus independent. Some form of self-dumping bucket conveyor is in general use for coal.

Mechanical Stokers.—The use of mechanical stokers in large plants is universal. They are more efficient on low grade fuel, and by their use and that of coal and ash handling machinery, the employment of a large number of laborers in the boiler room is dispensed with, and the likelihood of labor troubles diminished.

Boilers.—Some form of water tube boiler is usually chosen for large plants because it may be made in large sizes without danger of explosion, and occupies less ground space per horse-power than the fire tube boiler. A two-story boiler room is usually required.

Engines.—The triple expansion engine has not been used in any large installation. In one recent installation a duplex compound engine, with the two low pressure cylinders horizontal and the two high pressure cylinders vertical, drives the generator. This is a mammoth unit of 5,000 k.w., and is the largest built.

Steam Turbines.—It seems as if we are on the verge of a radical change in the application of steam, as the introduction of the turbine makes an entire change in the usual layout of the power station. The steam engine has reached such a size that for large units it is heavy, clumsy, delicate of adjustment and requires constant skilled attention. On account of the inertia of the valves and reciprocating parts, the speed of the steam engine must be kept so low that the cost of the electric generator is greatly increased. In fact, it would seem that the limit in the size of steam engines for driving electric generators is about reached. If the claims of its advocates are only partly realized, the steam turbine is the ideal machine for driving alternating current generators. The efficiency of the steam turbine is claimed to be fully equal to that of the best steam engine; the turbine being a rotary machine, the thrusts caused by the reciprocating motion of the steam engine are avoided, thus relieving the foundation and frame of that strain, and facilitating the operation in parallel of alternating current generators; foundations and buildings for turbines are cheaper than for engines; as the electric generator is driven by the turbine at a much higher speed than by the engine, its cost is less; there being no valve gear and reciprocating parts in connection with the turbine, its maintenance is less, and there is no need of the skilled attendance during operation; as no oil is needed for the lubrication of the turbines, the steam may be condensed in surface condensers and used over again in the boilers. One of the most important advantages of the steam turbine for electric work is that between half load and 50 per cent. overload its efficiency is nearly constant, and that even at less than half load its efficiency is good.

Superheated Steam.—The amount which steam may be superheated when used for driving steam engines is limited on account of the carbonizing action of the steam on the cylinder and valve lubricants. With a special valve gear constructed for use with superheated steam, steam superheated to 150 deg. F. above the temperature corresponding to its pressure may be used. With steam turbines any superheat which it is practicable to obtain may be used, and great economy is effected by its use. Some of the makers of water tube boilers now make an attachment to be placed in the path of the heated gases within the brickwork of the boiler for superheating the steam. The amount of superheat which can be obtained by this device depends upon its heating surface, but enough heating surface may be placed within the brickwork of a boiler to obtain about 200 deg. of superheat. If it is desired to obtain a greater degree of superheat, it is advisable to use an external superheater.

Condensers.—In order to obtain the maximum economy by the use of steam turbines, as rare a vacuum as possible should be maintained by the condenser, the usual specification calling for 28 in. This necessitates a larger and more expensive condenser than is usually installed with the same capacity in steam engines. The economy of the steam turbine increases very rapidly, both with the quantity of superheat and the rareness of the vacuum, and the limit of 28 in. has only been set because it is the limiting vacuum which it is practicable to maintain.

Steam Pressure.—Economy in the use of steam also increases with the steam pressure. With compound condensing engines the common pressure in use is 175 lbs. while with steam turbines the economical point seems to be about 200 lbs.

Piping.—The old fads of double-headers, auxiliary headers and loop systems have expired, and now the best practice is to make the piping as short and simple as possible, and make up in excellence of construction the security which it was once sought to obtain by doubling the installation. In some of the large plants recently built, the condensers have been set directly over tunnels connected with the water supply and the heavy piping necessary for the condensing water has been entirely done away with.

Auxiliaries.—The auxiliary apparatus, such as coal crushers, coal and ash handling machinery, stoker machinery, boiler feed pumps, condenser pumps, air pumps, cranes, exciters, elevators, etc., require a large amount of power for their operation, and the piping for the engines furnishing this power is expensive. It is recommended that these auxiliaries, so far as possible, be driven by motors, preferably induction motors. There will be a gain in economy over steam operation, and a large amount of high pressure steam piping will be done away with. Any machine which should run at a reasonably constant speed can be operated by means of an induction motor, and one which requires a variable speed can be run with a direct current motor.

For one large alternating current plant, the construction of which is now pending, it is proposed to furnish current for the auxiliaries and for the excitation of the generators as follows: Small alternating current generators, driven by turbines, are to be installed to furnish current of a voltage suitable for driving all the induction motors in the plant. Rotary converters, driven by this current, furnish the direct current, probably at 250 volts, for exciting the main generators, and for lighting the plant. A storage battery on this 250-volt circuit steadies any fluctuations and furnishes a reserve in case of a break-down. In this way the running of the auxiliaries, the excitation of the generators and the lighting of the plant are made entirely independent of the main current supply.

Division into Units.—In order to prevent, as far as possible, the crippling of the entire plant by an accident to any part of it, some of the more recent installations have been divided into units, each unit consisting of a generator, engine and condenser, together with the necessary number of boilers to furnish steam for the engines and the auxiliaries in connection with the boilers.

Frequency.—By common consent a periodicity of 25 cycles per sec. has been adopted in the United States for alternating current power work.

Phase.—Where the generator voltage is used in transmission, it is the accepted practice to generate three-phase current. Where the generator current is stepped up for transmission, it is the custom with some to generate two-phase current and in stepping up the current for transmission change it to three-phase. In most city installations the desired transmission voltage is less than 15,000, and as this voltage can be obtained with modern insulation in well designed generators, unquestionably the best practice is to generate at the transmission voltage, because this obviates the use of step-up transformers. Where the desired transmission voltage is above that which can be obtained in the generator, it is common to generate at a low voltage and raise to the transmission voltage by means of step-up transformers.

Operation of Generators.—For railroad and power purposes there is no great difference between the running of alternating and direct current generators. If there is any difference it should be in favor of the alternating current machine, owing to the substitution of rings for the commutator, and the slightly greater efficiency owing to the absence of brush friction and losses. The large modern machines are made of the revolving field type, the revolving parts carrying low voltage current and the high voltage confined to the stationary parts with little risk of accidental contact with persons. With engines of good regulation and similar types of valve gear there is no difficulty in running engine driven alternating current generators in parallel, and with generators driven by turbines which have a constant impulse throughout the entire revolution, operation in parallel becomes a simple matter.

Switches.—In recent installations, the switch contacts are broken in oil and each switch is built in a brick fire-

*Abstract of a paper by Mr. Richard McCulloch, presented at the 22d annual convention of the American Street Railway Association, September, 1903.

proof compartment. The busbars are divided into several sections, so that in case of a short circuit any section may be isolated. All switches are opened and closed by means of a motor running on an auxiliary circuit controlled by the switchboard attendant. No high voltage current is brought to the switchboard.

Transmission Voltage.—The advantages which alternating current transmission offer lie in the possibility of transmitting large amounts of power over long distances with comparatively small wire. Since the size of the wire necessary, decreases as the transmission voltage increases, there seems to be no reason why, for city use, where heavy loads must be transmitted, the limiting transmission voltage should not be the limiting voltage at which current can be produced in the generator, except that voltages above 15,000 require cables of high cost. It is unquestionably the best practice to carry the high tension cables underground in conduits. There are some large cities where alternating current at a pressure of 5,000 volts or higher is carried on overhead wires strung along city streets, but although quite a sum of money is saved in the initial cost of feeders, the true economy of such an installation is doubtful. Serious interruptions to traffic and perhaps injury to the central station and sub-station machinery are invited by short circuits and grounds, while the danger to human life is such that the company is liable to be ordered to place the high tension wires underground.

Transmission Cables.—As by three-phase transmission a minimum of copper transmits a given amount of power with a given loss, this is the system which has been generally adopted for transmission. Where the feeders are placed underground, three conductor cables are used, the three conductors being separately insulated and then surrounded by a lead sheath. Formerly rubber was the insulation used for this purpose, but paper has come rapidly to the front and at present paper insulation is preferred by many. Paper does not soften under heat like rubber, and the cable has the advantage of being cheaper than rubber and of having a somewhat greater overload capacity. The weak part of any cable is the joint, and great care should be taken in splicing to exclude all moisture. This is especially true of paper insulated cables. An extra cable should always be provided, so that the maximum load of the sub-station may be carried with one cable out of service.

Conduit.—The ducts at present laid are usually of cement-lined iron pipe, tile in either single or multiple duct, and concrete tubes. It pays to imbed the ducts well in concrete, so that an excavation under the conduit line will not cause settling.

Sub-Stations.—For city use the location of the sub-stations is closely determined by a study of the density of the traffic. In interurban construction there are two different opinions maintained regarding sub-stations. One is that sub-stations should be miniature power stations, contain a large quantity of apparatus, in charge of skilled attendants, and be spaced at rather long intervals along the road; the other idea is that sub-stations should be frequent, contain little reserve, and should be taken care of by the station agent or some other employee, whose principal duties are not the care-taking of the sub-station. In city practice, however, there is no question but that the sub-station should be designed and built with as much care as that used in the power plant construction, that it should contain reserve apparatus enough to tide over any ordinary breakdown, and that it should be constantly in charge of skilled attendants.

The high voltage current entering the sub-stations is handled by brick-inclosed, oil-break, motor-operated switches, just as in the power station. From the switches it passes to transformers, where its voltage is decreased to that suitable for driving the converters. This current, fed in at the alternating current end of the rotary converters, produces the 575 or 600-volt direct current which is sent to the direct current busbar for transmission to the trolley wire. The transformers are cooled either by water circulating around the shell or by air blown through the windings.

Rotary Converters.—A size of rotary converter which has been largely adopted for city work is 1,000 k.w., although one large installation has 1,500 k.w. rotaries. There seems to be no reason why rotary converters should not be built in as large sizes as direct current generators, which have been successfully built in sizes of 2,500 k.w. The rotary converter is just as reliable as the direct current generator, and there should be about the same reserve capacity in a sub-station as is allowed in a direct current station; that is, one reserve machine to every three or four units. Where the load is subject to sudden fluctuations, it is customary to place a reactive coil in the transformers and provide the rotaries with series windings on the pole pieces, in addition to the shunt windings. For city use rotaries have simple shunt fields, and if they are kept well loaded at all times, their direct current voltage is uniform. The sub-station of a large city system has such a large output that the momentary fluctuations noticeable in a small system are lacking. The load varies with the time of day; the attendants usually have plenty of time to prepare for any change in load, and there is no reason why they should not keep the rotaries well loaded.

Storage Batteries for Sub-Stations.—Storage batteries have been installed in many of the large sub-stations for the purpose of steadying the load on the rotary converters, taking care of the peaks of the load and creating a reserve capacity in the sub-station in case of a break-down of the machinery. If it is possible, with any reasonable degree of accuracy, to draw the load curve for a proposed sub-station, the question of whether it is more economical to install rotary converters or storage batteries to take care of the peaks may be determined in advance. It should be taken into account that a sub-station battery carrying the peak of the load not only takes the place of a certain amount of rotary capacity, but exercises a valuable smoothing-out effect on the load, replacing an equivalent amount of station capacity at the central power plant; so that the investment in battery should be compared with the investment in rotaries, high tension feeders, and in generator and steam plant capacity thus dispensed with at the power plant. Figured at the one-hour discharge rate, the relative first cost of storage battery as compared with rotary converter, feeder and steam plant is approximately $90 per k.w. for the storage battery and $130 per k.w. for the converter plant, steam plant and transmission line, the latter figure being $30 for the rotary plant and $100 for the steam plant and transmission line. This estimate for rotary and steam plant is based on the nominal ratings of the machines and does not take into account their overload capacities. A battery worked on the peak at its one-hour rate is likely to cost about the same or somewhat less than the apparatus which it displaces.

In laying out a sub-station, it would be well to design the building with reference to the future installation of storage batteries.

In an alternating current transmission the losses at maximum load are likely to be about as follows:

	Per cent.
High tension feeders	3
Transformers	2½
Rotary converters	5
Low tension feeders	7 to 10

making a total transmission loss between the generator and the trolley wire of 17½ to 20½ per cent., which is about the same as that estimated for the direct current transmission.

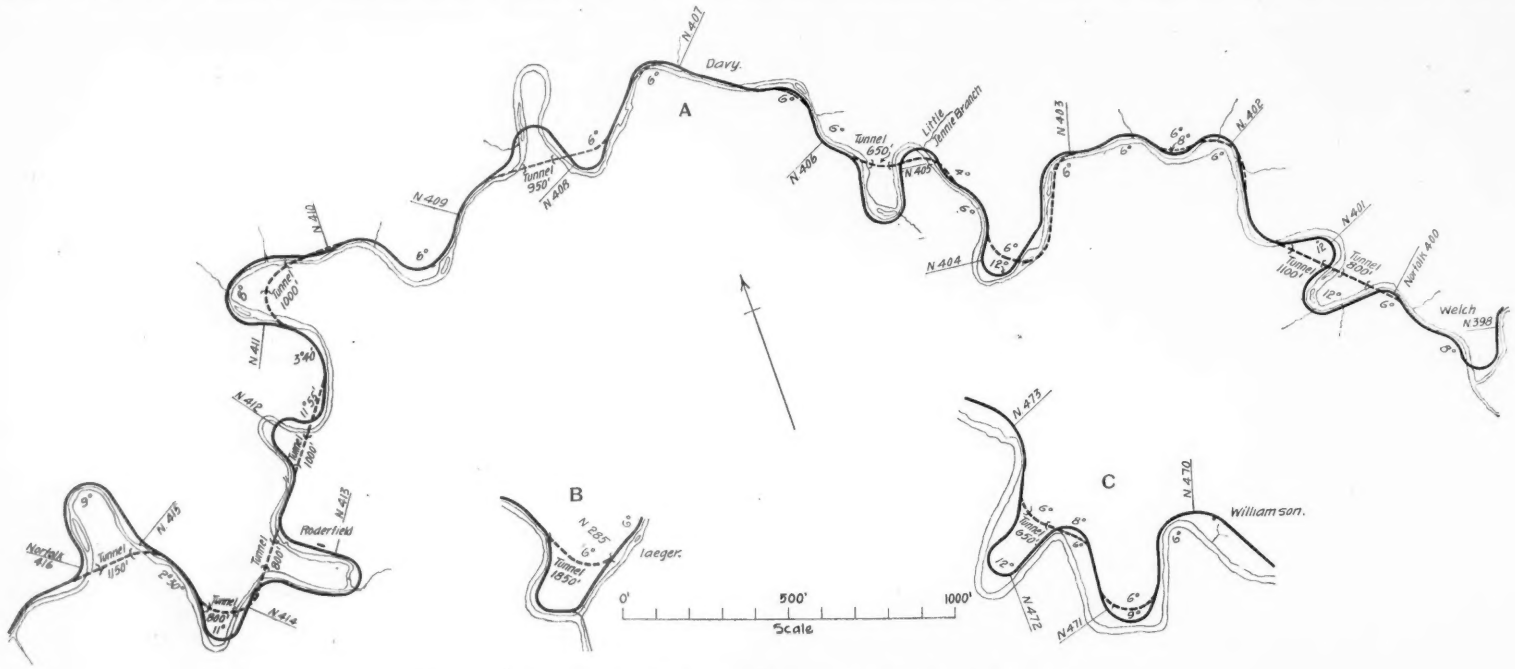
The real problem which confronts most railroad companies in large cities is the question of the substitution of an alternating current plant equipped with modern machinery in large economical units to replace several direct current plants badly located with reference to the load and containing more or less antiquated apparatus. It may be argued in favor of the operation of several power plants, as against one, that the power plants being located in different parts of the city, there is little likelihood of the same fire, flood, cyclone or other calamity destroying all of them, and thus entirely crippling the road. This, and the fact that the direct current system is the simpler and the more easily comprehended by ordinary power plant men, are about the only arguments which may be advanced for the several power plant plan.

The greatest advantage of the one central plant is the fact that better supervision may be obtained, as it is much easier to get one good set of operators than several, and in times of trouble it is much easier to keep one plant in operation than several. The economy of generation where the same quality of apparatus is installed, would not vary greatly, as the cost per kilowatt for the generation of power decreases very slightly after a large output has been reached, and it is assumed that in either case the plants would be of large size. To choose between the direct and alternating current systems of generation, very careful estimates of the cost of installation and operation should be made in each case, and decision should be reserved until after these estimates are compared. Where doubt exists, preference should be given to the direct current system on account of its greater simplicity, unless there is likelihood of a great expansion of the system, when direct current transmission might prove burdensome.

Norfolk & Western Road Improvements.

BY GEO. L. FOWLER.

In improvements in the grades and alinement of the main line, the amount of work under contract and in contemplation is great. The explanation of this is that when the road was located and built through the mountain sections, there was little traffic awaiting, and so, as in the case of other pioneer lines. It was necessary to locate the line in a way to be cheaply built by following the bendings of the streams, necessitating many curves of short radius, which now present the double disadvantage of increasing the resistance of all classes of trains and limiting the speed of passenger trains.



Map of Line Between Vivian and Naugatuck—Norfolk & Western.

Between Vivian and Welch the new work has not yet been mapped out, and the heavy work already undertaken starts just west of the latter place. Here 10 deg. and 12 deg. curves have been entirely eliminated and the road carried on a tangent through two tunnels of 800 ft. and 1,100 ft. respectively, over three bridges across the Tug River, reaching the main line again about 7,000 ft. from the point of departure, and cutting 3,250 off from that distance. Here at the first step there is a saving of nearly one-half in the distance run, the elimination of two curves of 12 deg. and one of 10 deg., and the substitution of a tangent for this crooked alinement. The new line then follows the old line for about three

*For an account of the Ventilation of the Elkhorn tunnel East of Vivian see *Railroad Gazette*, May 10, 1901.

miles, cutting out 8 deg. and substituting 6 deg. curves in a number of places and finally swinging around in a half circle on a 6 deg. curvature, doing away with a similar bend of 12 deg. Next by an easement at Little Jennie Branch a curve of 11 deg. is done away with and by the construction of a tunnel 650 ft. long, two curves of 8 deg. and 12 deg. respectively are wiped out and the line shortened from 6,250 ft. to 3,000 ft.

Again through Davy, curves of 6 deg. are substituted for those of 10 deg. and 11 deg., and then at Mill Branch about three-quarters of a mile beyond the station a cut is made into the hillside, a 12 deg. curve reduced to 6 deg., a tunnel 950 ft. long substituted for one of 190 ft.;

Fig. 3.—Elevation of Tracks West of Roanoke, Va.

Fig. 5.—Rock Cut at Montgomery Tunnel.

the latter being on a 9 deg. curve while the former will be straight. The reduction of distance in this case will be 1,500 ft., with the added advantage of a tangent over a very crooked road.

For the next mile and a half little will be done beyond the easing of a single curve. Then follows some exceedingly heavy work, involving the construction of five tunnels in close proximity to each other and having an aggregate length of 4,750 ft. and of as many bridges over the Tug River. In this work the maximum curvature is 6 deg., much of it is on a tangent, and the total distance between points where the new alinement leaves the old is reduced from 6 miles 750 ft. to 3 miles 4,200 ft., and this is accomplished by the construction of about 2 miles 4,200 ft. of new track, of which less than a mile is tunnel, or a little more than the total distance saved.

The distance covered by the improvements thus detailed is a little more than 16 miles, and is represented by the section marked A on the engraving.

Beyond this point for a distance of about six miles the road is comparatively straight and the improvements are limited to the easement of a few 7 deg. and 8 deg. curves. At 422 miles from Norfolk and 22 miles west of Welch there is a tunnel, shown at B, which is 1,850 ft. long, part being on a 6 deg. curve, which cuts off a long bend on the present line, eliminates two 12 deg. curves and reduces the distance between points of departure from one mile to 2,500 ft., of which 1,850 ft. is tunnel.

In the next 12 miles there is nothing to be done save the easement of a few curves and the construction of one short tunnel. Between mileposts 435 and 436 from Norfolk a tunnel 400 ft. long constructed under practically the same conditions as at the point marked B, cuts down a run of one mile to 2,750 ft. Again between mileposts 439 and 440 an 800 ft. tunnel is used under similar conditions to eliminate a 10 deg. curve and reduce a distance of 3,500 ft. to 1,700 ft. Near milepost 446, a tunnel 1,650 ft. long does away with a 11 deg. curve and reduces the distance from 6,500 ft. to 2,150 ft. The next heavy tunnel work is shown at C, just beyond Williamson, where by cutting into the bank on one bend of the river

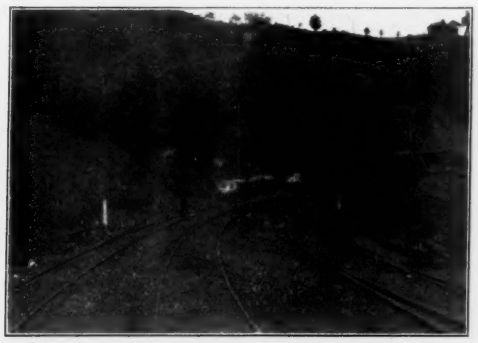


Fig. 6.—East End of Eggleston Tunnel No. 1.

Fig. 8.—Along the Banks of the Tug River.

and putting a 650 ft. tunnel through another, three curves of 9 deg., 8 deg. and 12 deg. respectively are eliminated and the distance reduced from 2 miles to 6,250 ft.

From this point to Naugatuck, 484 miles from Norfolk, the work consists solely of curve easement with the exception of one tunnel 650 ft. long.

In a distance of 84 miles from Welch to Naugatuck there will be built eight tunnels with an aggregate length of 17,950 ft., and 23 bridges over the Tug River. In addition to this there are a large number of points where the line will be straightened, thus making it possible to run faster passenger trains and heavier freight trains over the whole section, besides reducing the actual distance by about eight miles.

Taking the average monthly tonnage of coal delivered at Norfolk as stated in the issue of the *Railroad Gazette* for July 24 at 196,888 as representing the haulage over this section eastbound only, the saving will be 1,575,104 ton miles per month over the most tortuous and difficult portion of the road.

In addition to these improvements between Vivian and Naugatuck, work is in progress all along the line west of Roanoke. Just west of the city, a grade is being reduced by the elevation of the tracks, a portion of the work in progress being shown in Fig. 3, which represents the westbound track raised about 4 ft., while the eastbound is still down to its original level.

In some places the track is raised as much as 7 ft., the work being done without interruption to the traffic. It is accomplished partly by side filling and partly by jacking up between trains and filling in beneath the ties.

Again further on, single track tunnels are being enlarged to double track. The one at Montgomery, Va., is shown in Fig. 4, and the face of the rock cut, in the approach to the same with the workmen's shanties at the top in Fig. 5. Along the banks of the New River west of Radford at Eggleston and Glen Lyn, the work of double tracking the road is in progress. Here the task involves that of cutting into the cliffs of limestone. An idea of the character of portions of the work can be gained from the reproductions of the photographs, Figs. 6, 7, 8 and 9.

Fig. 4.—Enlargement of Tunnel at Montgomery, Va.

Fig. 7.—Along the Banks of New River.

Extensive as these improvements are they do not cover all that are in process of realization.

After leaving Naugatuck westward the present line turns aside from the valley of the Tug River and runs up that of Pigeon Creek, from which it climbs the separating ridge and comes down the banks of Twelve Pole Creek to Kenova. This climb over the ridge is a stiff one for the loaded westbound traffic and the grades materially reduce the hauling capacity of the locomotives. The track is single over this section and the location was made where it is in order to serve the prospective coal fields.

As the traffic has outgrown the capacity of a single track road it was decided to build another line down the valley of the Tug River to its junction with the Big Sandy and thence along the banks of the latter to the Ohio at Kenova. The length of the new line will be 59 miles as against 84 by the old. Nor is this all. Following, as it does, the flow of the Tug and Big Sandy Rivers the whole distance from Naugatuck to Kenova, the grades are all favorable with the exception of one averaging about 13 ft. to the mile for a distance of two miles approaching the Ohio River bridge. This grade is approached by a level section 17 miles long. From Naugatuck to this point the grades run from short level sections to about $2^{7}/_{10}$ ft. to the mile.

On this new line there will be seven tunnels with an aggregate length of 9,868 ft. In the location and alinement every pains have been taken to obtain not only easy grades but easy curves with the result that in following the crooked Tug down to its junction with the Big Sandy there is but one curve of 8 deg., the maximum with this exception being 6 deg., of which there are 15. From the mouth of the Tug to the Ohio there is but one curve of 6 deg., the maximum of the remainder being 4 deg. This new line will therefore afford an easy outlet to the west from the Pocahontas coal fields and enable the locomotives to haul exceptionally heavy trains. At the same time it will give the road what will practically amount to a double track from Naugatuck to Kenova. For it is the intention to use it for westbound traffic only, which is the direction of loaded movement, while the eastbound empties will be returned over the old road.

With this line the account of the large improvements in progress upon the Norfolk & Western may be considered to be concluded, but it by no means includes all of the minor pieces of work that are constantly arising. The main lines of traffic have already been outlined, and it is from the business transacted over these that the revenues of the road are derived, but as nearly all of this business originates on its own lines to flow east and west from the center of such origination, it follows that there must be feeders at some point. This is the fact. The road is in the same condition that the pine carrying roads of Michigan and Wisconsin once were. Innumerable private operations call for means of transporting their output of iron ore or timber in some sections and of coal and coke on others to the main line, and in order to meet this demand, spurs are sent out all along the route through the iron and coal regions; spurs that vary in length from a few hundred yards to several miles, and which are built under various conditions of mutual agreement between the operators and the railroad company. In one case there is a spur 16 miles long upon which there are 10 coal and coke operations. The location of these spurs is, of course, not performed with the same rigid limitation as to grades and curvatures that obtains in main line work, but it necessarily calls for substantial construction since it is to carry the same heavy locomotives and the same cars of 80,000 and 160,000 lbs. capacity that are used elsewhere. An idea of the magnitude of this work may be gained from the fact that 40 locomotives are constantly engaged in gathering the output of the coal fields and hauling it in towards the great distributing centers of Bluefield and Williamson.

In carefully reviewing what has been said in these three articles, the conclusion cannot fail to be reached that the Norfolk & Western presents a fine example of what may be considered as a representative American railroad, in the character of its permanent way, the facilities for handling traffic delivered at its terminals, the

comprehensiveness of its yard arrangements, the care that has been bestowed upon the designing, construction and maintenance of its rolling stock, and the broad and liberal-minded policy that has been pursued in the development of the property and the improvements effected. Its position is somewhat unique in that almost the whole of its heavy business originates on its own lines and flows to opposite terminals, a feature that suggests the interest centering about the great contributory industry as a special field of inquiry.

In concluding these articles I wish to express an obligation to Mr. L. E. Johnson, General Manager, and Mr. Charles S. Churchill, Chief Engineer, for the courtesies extended in the collection of data. The improvements detailed in the last two articles have been designed by these gentlemen, and it is under their supervision that they are being carried out.

Bucyrus Wrecking Crane with Test Load of 100 Tons.

A 100-Ton Wrecking Crane.

The Bucyrus Company has recently designed and placed on the market a 100-ton wrecking crane which is the most powerful crane of this type ever built. Several have been sold to the Southern, the Wisconsin Central, and the Missouri Pacific. The accompanying engraving shows the crane with a test load of 100 tons of pig iron. The details for the following description have been furnished by Julian L. Yale & Company, Chicago, the selling agents.

With this crane any load within its capacity may be lifted by raising the jib itself without moving the hook block; or, by clutching both winding drums at once, the jib may be raised and the hook block lowered, or vice versa, at the same time, moving the load in or out horizontally. This latter movement, called the "equalizing movement," enables the crane to handle heavy loads with absolute security, because when the load and jib are equalized, the brakes may be released and the load will hang suspended until pushed into a new position by the engines. A load can be raised directly by the jib, carried over intervening wreckage, and deposited at any point within reach of the crane without re-handling.

The car is built of heavy structural material and steel castings. It is provided with five jack-arms, one at the middle and two at each end. The car is mounted on two four-wheel trucks with 33-in. steel-tired wheels with cast-steel centers. The arch-bars are 1½-in. x 6-in. with ⅞-in. x 6-in. bottom strap. The bolsters are heavy 9-in. I beams, with ¾-in. x 12-in. cover plates, and are supported by four nests of four springs each under each bolster. The car is fitted with Westinghouse air-brakes, 12-in. x 12-in. cylinder, and quick-acting triple valve, giving a braking force of 70 per cent. of the weight of crane. The brakes are applied to every wheel. "Chicago" trussed brake-beams are used. M. C. B. automatic couplers are provided at each end of the car, with yoke attachment.

The two side frames are bolted to two 9-in. x 12-in engines, with the crank shaft extending across the back of the side frames. Two trains of gearing are driven by this crank shaft, one extending downward to drive the swinging or revolving machinery, the other extending upward to drive the hoisting machinery. The three hoisting drums are side by side upon the same axis instead of having three separate shafts as in previous designs, and are provided with one train of powerful spur gears by which any of the three drums may be driven separately or together. Two of the three drums are used to wind up the two hook blocks while the third winds the powerful jib hoisting mechanism which raises or lowers the jib by means of the large tackle sheaves in the jib guys. The two drums for the hook blocks are mounted upon a steel rotating drum or barrel 16 in. in diameter, cast hollow and provided with jaw clutches whereby either of these drums may be engaged with the barrel and made to rotate with it as desired. This barrel is provided with projecting journals about 8 in. in diameter. The length over all is less than the clear inside width between the side beams. Through a large hole in each side frame a hollow stud or thimble projects about 8 in. inside of the side beam, the hole in each stud acting as a bearing for the journal on that end of the barrel. On the outside of one of these thimbles is mounted the hoisting gearing, while on the outside of the other thimble is mounted the jib hoisting drum. The rotating barrel is provided with another jaw clutch by which it can be engaged with the jib hoist drum when desired. The jib hoist rope is wound over the upper side of the drum, while both the hook block ropes are wound over the lower side of their respective drums.

When the hook block drum and the jib hoist drum are both engaged with the barrel the load hanging on the hook block tends to turn the drums and winding barrel in one direction, while the pull on the jib guys and through them on the jib hoists drum, tends to turn the drum and barrel in the other direction. When a load is suspended the brakes may be disengaged, and the load will hang safely in the air without any tendency to run down. As already mentioned, a friction brake is provided which holds the hoisting gearing, and hence serves to support a load upon any of the three drums.

The swinging machinery consists of a train of spur and miter gearing, driven by a pair of standard friction clutches, one of the clutches serving to swing the crane in either direction while the other is disengaged. When both clutches are out of gear a friction brake is automatically applied to prevent the crane from swinging; but if a heavy side pull is put upon the jib such as is often caused by attempting to drag out wreckage by attaching a locomotive to the crane, this friction brake will slip and permit the crane to swing before the side strain becomes sufficient to break the gearing. These clutches can be thrown in or out while hoisting. The crane can be turned through the full circle in one minute. All clutches are attached to their respective levers through spring connections, permitting the levers to be set in position without watching the jaw clutches.

Steam is furnished by a vertical boiler 50 in. in diameter and 8 ft. 9 in. high. The working pressure is 125 lbs. per sq. in. The water tank holds 385 gal. The engines have Marshall reversing valve gear.

The weight in working order is approximately 175,000 lbs. The weight is distributed over a wheel base of 17 ft. 6 in. With outriggers, a load of 100 tons can be lifted by the main block at a radius of 16 ft., and a load of 42 tons at 25 ft. With three parts of rope, the auxiliary block will lift a load of 40 tons at a radius of 27 ft. or less.

Water-Softening Plant, Pennsylvania Co.

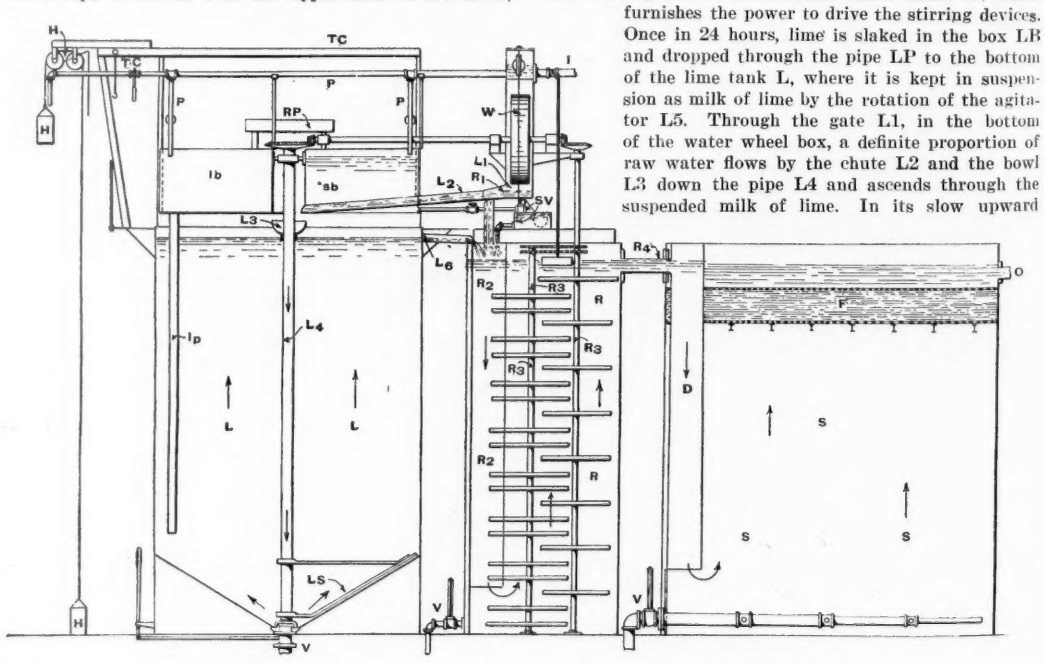
A typical installation for water softening on the Pennsylvania Lines West of Pittsburg, North West System, is located at Middlepoint, Ohio, where a machine of capacity to soften 10,000 gallons of water an hour has been in use for some time. The water to be treated is a particularly bad one, yet the softening and purification are practically complete as will be seen from the following analysis (grains per U. S. gallon).

Raw water.		Treated water.
16.50	Calcium carbonate, $CaCO_3$	2.14
16.08	Calcium sulphate, $CaSO_4$	...
...	Magnesium carbonate, $MgCO_3$	1.32
19.65	Magnesium sulphate, $MgSO_4$	...
1.61	Magnesium chloride, $MgCl_2$	...
...	Sodium carbonate, Na_2CO_3	0.21
3.76	Sodium sulphate, Na_2SO_4	43.81
...	Sodium chloride, $NaCl$	2.64
0.65	Silica, SiO_2	0.58
0.19	Oxides of iron and aluminum, Fe_2O_3. Al_2O_3	0.19
7.46	Volatile and organic matter	1.23
63.52	Total solids	51.61
54.68	Scale-forming solids	4.23

Besides the impurities shown in this analysis, the raw water is impregnated with sulphuretted hydrogen which renders it especially corrosive to the brass fittings.

The chemicals used in the softening are fresh lime and soda ash, and this particular water requires for treatment approximately 4.75 lbs. of lime and 4.5 lbs. of soda per thousand gallons. Running at full capacity, 1,744 lbs. of incrusting calcium and magnesium salts are removed per day by this machine.

Referring to the sectional view: The water enters the inlet I and passes to the overshot water wheel W, which furnishes the power to drive the stirring devices. Once in 24 hours, lime is slaked in the box LB and dropped through the pipe LP to the bottom of the lime tank L, where it is kept in suspension as milk of lime by the rotation of the agitator L5. Through the gate L1, in the bottom of the water wheel box, a definite proportion of raw water flows by the chute L2 and the bowl L3 down the pipe L4 and ascends through the suspended milk of lime. In its slow upward progress it dissolves a sufficiency of calcium hydroxide and becomes saturated lime water. Owing to the absence of agitators in the upper portion of this tank, the liquid there is comparatively quiet and by the time the exit L6 is reached, all the heavy particles of milk of lime have been left behind by the lime water which issues clear and of constant strength. Flowing through the chute L6 it meets the main body of raw water from the gate R1 as well as



Water Softening Plant at Middlepoint, Ohio—Pennsylvania Lines West.

the proper proportion of soda ash solution which has previously been prepared in the box SB. The soda solution is fed by means of the valve SV, which is so constructed and automatically operated that the flow of solution is always proportional to the amount of water to be treated. The water and the reagents then pass downward through the reaction pipe R2 into the reaction tank R. This tank is of such a size as to permit the water to remain in it for a period of half an hour, during which time it is very thoroughly agitated by means of the stirrer bars on three vertical shafts R3, R3, R3 actuated from the water wheel by beveled gearing and chain transmission. When it is ready to pass out at R4 and through the downtake D into the settling tank S, all the reactions are completed and the precipitate is in such condition that it will settle very readily. The precipitate subsides to the bottom of the settling tank S; the treated water rises slowly and passes through the wood fibre filter F, where the very small quantity of matter which is carried in suspension is deposited. The water then flows clear and soft from the outlet O to the storage tank. At intervals the precipitates which have settled to the bottom of the tanks are disposed of by opening the valves V, V, V. In washing the filter and disposing of the precipitates, approximately 3 per cent. of the total amount of water treated daily is used. When required, water is supplied to the lime box LB and the soda box SB through the piping P. This also supplies water for operating the brake-controlled chemical hoist H, which has capacity to raise 200 lbs. of reagents in 10 seconds. By means of the trolley crane TC and the receiving platform RP the chemicals are conveniently distributed to their respective boxes.

The builders of this plant, Industrial Water Company, of 126 Liberty street, New York, have also installed another plant of a like capacity and treating water of the same general character at Washington, Hardin County, Ohio, about 40 miles farther east on the same railroad, where it is giving equal satisfaction.

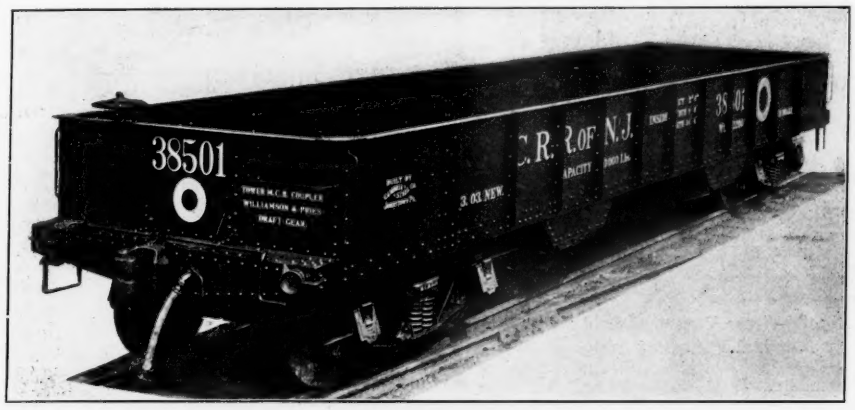
Steel Gondola Car for the Jersey Central.

The Cambria Steel Co. has recently built for the Central Railroad of New Jersey 500 steel hopper-bottom gondolas of 80,000 lbs. capacity, the general drawings of which are shown in the accompanying engravings. Rolled sections have been used throughout. The cars weigh 32,200 lbs. and are 34 ft. 4 in. long, 2 ft. 6 in. from floor to top of side and 8 ft. 6 in. wide, all inside measurements. There are two hoppers in the floor with a 3-ft. door opening, which extend the width of the car and have no side slope or sloping hood over the center sills. The doors are made in two parts and are operated by a chain running over a sheave between the center sills to the winding shaft which projects out on one side of the car with a square-end and ratchet wheel.

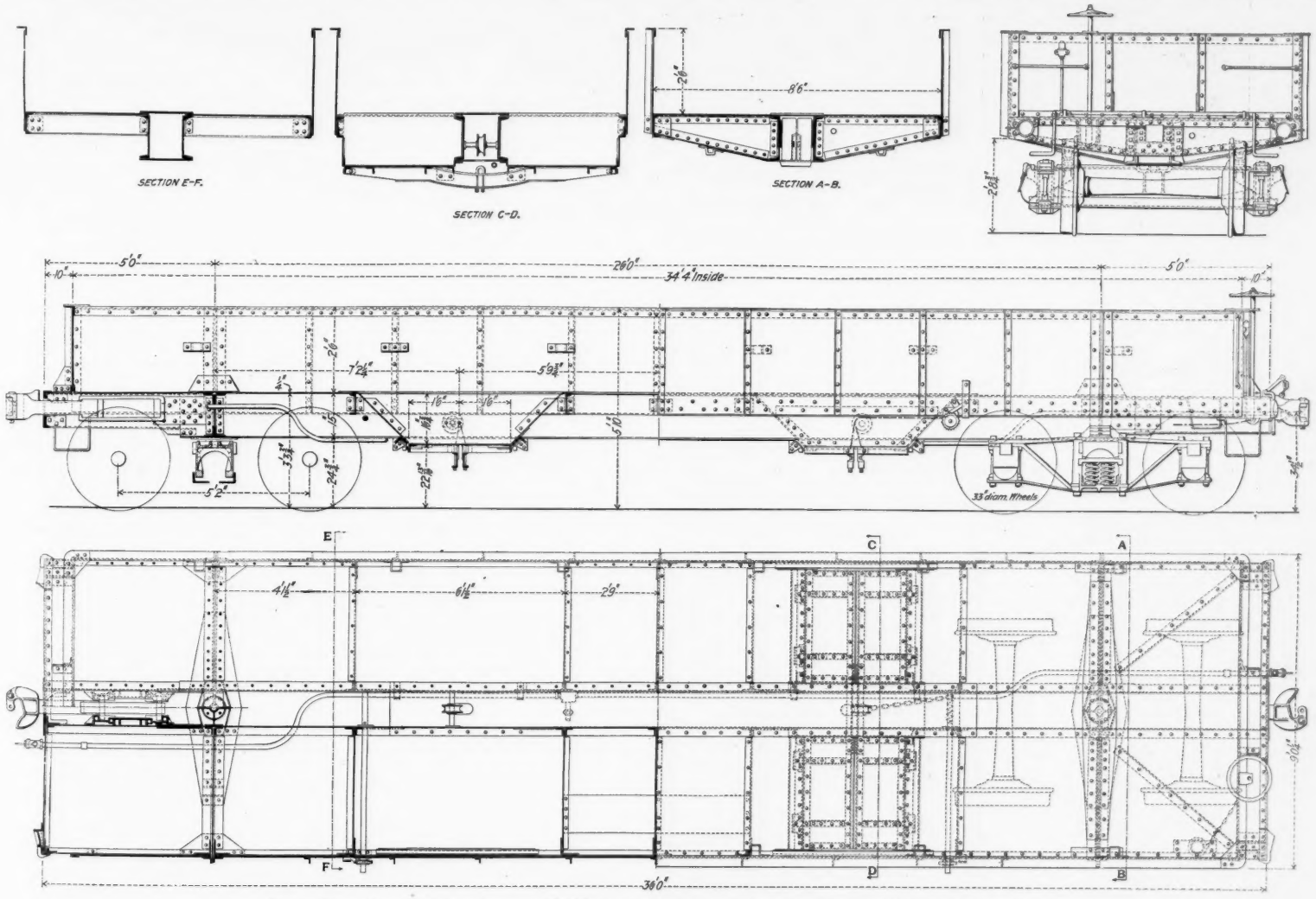
The center sills are 15-in., 33-lb. channels, spaced 12 in. from back to back. The draft sills, which are 12-in., 25-lb. channels, are spliced to the center sills 12 in. outside the bolsters, the top flanges being in line. Splice plates 9¾ in. x ¼ in., inside and out, and ⅞-in. rivets, 10 on each side of the joint, are used. This splicing of center sills outside the bolsters is now considered the best practice and is used on nearly all new construction. Damage to the end sill or draft sills can be easily repaired by cutting the joint and removing the damaged members when they can be straightened or replaced with the least amount of time and trouble.

The side sills in this car are light 7-in. channels, continuous from end sill to end sill. The side plates are riveted on the outside through the web, and the floor plates are riveted through the top flange. A built-up construction of plates and angles is used in both the end sill and bolster. Single angles riveted on the outside of the side plates vertically, and a heavy angle on the top edge of the plates, stiffen the sides and ends against bulging. The draft gear is the Williamson-Pries tandem spring gear, which is standard on this road. The cars are mounted on arch-bar trucks with channel spring planks and cast-steel bolsters. The workmanship and finish are excellent and the cars are proving very satisfactory in service.

We are indebted to Mr. George W. Wildin, Mechanical Engineer of the railroad company, for the drawings.



80,000-Lb. Hopper Bottom Gondola Car—Central Railroad of New Jersey.



Plan, Elevations and Sections of 80,000-lb. Steel Hopper Gondola—Central Railroad of New Jersey.

Tests of Hohenstein Boilers.

In a recent report of the Chief of Bureau of Steam Engineering of the United States Navy, an account is given of a series of exhaustive tests made on a Hohenstein water-tube marine boiler to determine its suitability for naval use. The boiler question for naval ships is a very important one just now. The report remarks that the present problem of the modern battleship is not that of the gun and its mount, but of the boiler and its installation. The battleships at present under construction will contain water-tube boilers of three types, viz.: Babcock & Wilcox, Niclausse and Thorneycroft, in the proportion of four, two and one-seventh respectively.

The Hohenstein water-tube boiler is a recent competitor in the marine field and its builders, the Oil City Boiler Works, Oil City, Pa., were encouraged by the Bureau of Steam Engineering to design and build a boiler and turn it over to the Bureau to test its evaporative efficiency and endurance.

The boiler was built in conformity with the Bureau specifications for the cruiser "Denver" class, and it was placed in an air-tight steel house approximate in dimensions to one of the fire-rooms of the "Denver."

A feature of the boiler to which special attention was directed in the report is the arrangement in pairs of the tubes in such a way that each tube is free to expand independently of the others, preventing longitudinal stresses. Also the entire down-flow occurs within tubes in a comparatively cool place, while there is an upward trend to the current in the tubes and headers exposed to the hottest gases. This, it is thought, obviates any probability of reverse currents occurring at any part of the water circuit. Another feature specially mentioned is the construction of the plugs in the headers opposite the tube ends. These plugs are of composition, and the material together with the use of a graphite lubricant makes it possible to remove and replace them without difficulty after any length of service.

The heating surface of the boiler was 2,174 sq. ft. for the first six tests and 2,130 sq. ft. for the rest, there

being 17 in all. The grate surface was 50.14 sq. ft. Six tests were of 8 hours duration, with natural draft; five were of 6 hours duration with forced draft; four of 4 hours, with forced draft; and one each of 3½ and 8 hours with forced draft. For the natural-draft tests the average equivalent evaporation from and at 212 deg. F. per hour per sq. ft. of heating surface was 4.82 lbs. The highest equivalent evaporation was 14.15 lbs. with a forced-draft pressure of 3 in. of water in the ash-pit. The highest equivalent evaporation per pound of combustible was 11.77 lbs. of water, with natural draft. The average efficiency of the boiler obtained in the natural-draft tests was 69.2 per cent. varying from 61 per cent. to 73.4 per cent. In the first case the firing was poor and irregular, averaging 13-minute intervals, with a thick fire. In the latter case the furnace was fired every six minutes and the fire was thin. The lowest efficiency of the boiler was 59.4 per cent., under forced draft giving the highest rate of evaporation. The boiler and furnace efficiency ranged from 68.3 per cent. for one of the natural-draft tests to 54 per cent. for the forced-draft test giving the highest evaporation.

As a result of the tests the board conducting them recommended that the Hohenstein boiler be given a place on the very limited list of straight-tube water-tube boilers of American design that have been found suitable for naval purposes.

The Marginal Protecting Strip.

Asphalt paving when laid on city streets next to car tracks, disintegrates and breaks up rapidly in the immediate vicinity of the rails. The most severe test for any kind of street pavement is to subject it to the pounding and grinding action of the tires of heavy wagons turning into and out of the car tracks. If the wagon wheels are spaced at a different gage from the track, there is a continuous grooving effect alongside the rails, which, combined with the crossing wear, soon causes ruts to form on each side of the rail. These breaks enlarge rapidly if not constantly repaired and the whole pavement is made unfit and dangerous for use. In cold weather when the asphalt becomes hard and brittle, the springing of the rails under heavy cars cracks the pavement and then frost helps on the destruction.

Fig. 1.—Unprotected Pavement.

Granite blocks laid in a dental course on each side of the rail reduce somewhat the destructive effect of wagon wheels entering, leaving or crossing the tracks, and hard bricks laid on edge have the same effect, but both of these methods are unsatisfactory when there is very heavy traffic. Granite blocks have a rough and uneven surface and a good bond cannot be made between the asphalt and the stones, which soon become loose and liable to cause trouble. Bricks make a smoother surface and can be better bonded to the pavement, but they vary in hardness to such an extent that no matter how well they may be laid, their surface soon becomes worn unevenly so that they are little better than granite blocks.

The condition of an unprotected pavement carrying very heavy traffic is shown in Fig. 1, which is a view of a section of track on Third avenue, New York City. It is estimated that the cost of maintaining the pavement on this line of track averaged $4,250 per mile of single track yearly in 1891 and 1892. Granite blocks were later tried with only fair success and asphalt blocks also; but these latter did not wear as well as the sheet asphalt alone.

In February, 1902, a section of the track where repairs had been most frequent and traffic the heaviest, was laid with an iron casting or marginal protecting strip next the rails. A few months later more protecting strips were laid, the first section having shown such good results, and at the present time more than 3½ miles of track on this line are laid with marginal strips, and asphalt between the rails. So far, the repairs to the paving have cost very little where the strips are in use. Four or five yards were repaired where the strips were improperly laid and in the meantime extensive repairs have twice been necessary to the sections north and south of the section protected with the marginal strips. Fig. 2 shows the condition of the street surface in March, 1903, the strips having been laid in February, 1902, and no repairs made since that time.

Fig. 3 shows the top surface of the strip and Fig. 4 the bottom surface. It is made of hard cast iron, 1¾ in. thick, 5½ in. extreme width, and each section is 7 ft. 6 in. long. The sections are made straight or curved to suit the track and the side away from the track has projections formed on it, making, as it were, a dental course in the pavement. Toe checks are cast on the top surface to prevent the slipping of horses and the bottom surface is recessed to give a good hold on the foundation. In the projection at each end of the strip there is a counterbored hole to take the heads of the expansion bolts. When the marginal protecting strip is applied to pavement already laid, a piece of asphalt next the rail of sufficient width to receive the strip, is cut out, and holes are drilled in the concrete foundation for the expansion bolts. A bed of Portland cement is laid on the concrete to receive the iron which is securely bolted down before the cement takes a permanent set. Pieces of flat iron, ¼ in. x 4 in. x 6 in., are placed under the joints between strips. Care must be taken to have a ¼ in. open joint between the strips and the rail to allow vertical and horizontal movement of the rails without disturbing the strips. After the strips are laid, the asphalt is repaired. The marginal protecting strip is made and sold by the American Brake-Shoe & Foundry Co., New York.

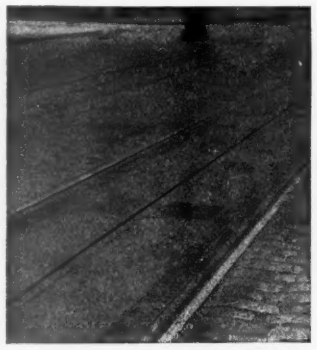


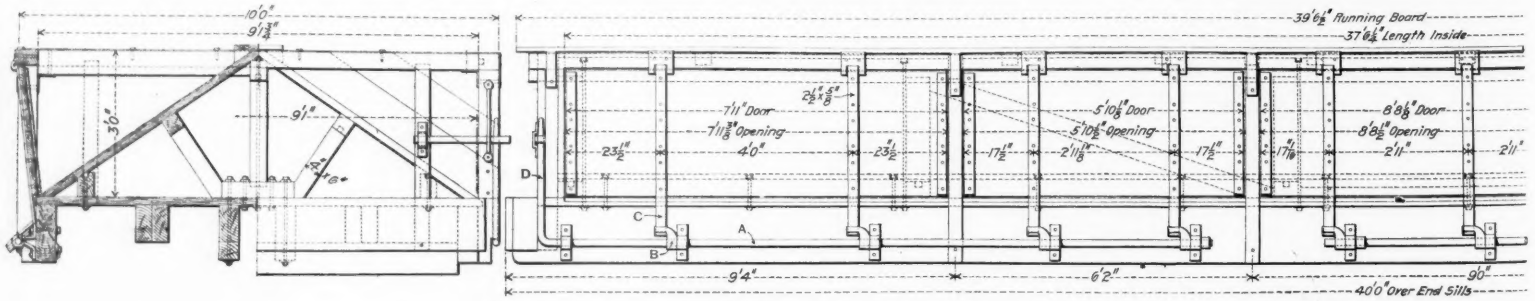
Fig. 2.—Same Pavement Laid with Marginal Protecting Strips.

Fig. 3.—Top Surface.

Fig. 4.—Bottom Surface.

Side Dump Car of the Norfolk & Western.

In carrying out the improvements on the Norfolk & Western which have been described in previous articles in the *Railroad Gazette*, it was necessary to use a dump car that would handle the material to be removed, quickly and economically. A plow could not be used because of the sharp curves existing in many places, where the cable would have been drawn along the chord of the arc in such a way as to be dragged over the face of the rocks around which the tracks are laid. A satisfactory car was made from a standard flat car, fitted with an inclined bottom and side doors as shown in the engraving. The floor has an inclination of 35 deg. from the horizontal and extends out to the full width of the car. This incline causes the material to slide freely and fall clear of the tracks so that no shoveling is required at the rails. The doors are 7 ft. 11 in. long. There are five on each side of the car, hung from the top and opening outward in the usual way. A rod A, 1⅝ in. in diameter held by brackets placed at intervals along the side sills, carries lugs B, which can turn up and hold the straps C, projecting downward from the door. This rod A, is itself held by the lever D, which is fastened by a bracket at the end of the car. Releasing this lever allows the lugs B, to be pushed out by the door and the load to be dumped.



Side Dump Car for Construction Work—Norfolk & Western.

The car used for this purpose is the standard class F C flat car of the road. It has a capacity of 80,000, and is 40 ft. long over end sills. The framing is of wood, stiffened by six 1¼ in. truss rods. The side sills are 4 in. by 14 in. and the intermediate sills are 4 in. by 9 in. The center sills are 5 in. by 9 in., strengthened by a subsill 4½ in. deep. The bolster is formed of two 7 in. I beams tied together by ⅝ in. plates at the top and bottom. Just in front of the bolster there is a heavy filling piece between the draft timbers which are 10 in. deep. The draft rigging has tandem springs.

Eye and Ear Examinations of Railroad Employees.*

If statistics could be gathered of the accidents caused by bad eyes, even for a single year, the showing would be appalling and would lead to renewed efforts to perfect the ocular status of railroad employees. In order to ascertain what was being done to regulate this important essential to transportation security, a committee was appointed (of which I was chairman) several years ago, by the Ophthalmological Section of the American Medical Association, to investigate this matter and report to the Section. The committee reported in 1901.

Letters of inquiry and a question blank were sent to every railroad in North America working over 100 miles. One hundred and twelve roads replied, aggregating 147,838 miles of road. Out of the 112, 77 require some kind of a systematic eye and ear examination of those employees who are actively engaged in running trains, and in giving and receiving signals. Twenty-nine of the roads require such examinations to be made by regularly appointed surgeons, 31 allow various kinds of employees to make the examinations; nine roads send doubtful cases to an eye and ear surgeon; 16 roads require examinations to be made by regularly appointed eye and ear surgeons, and four allow such examinations to be made by the medical directors.

One road requires re-examinations every six months, seven roads require re-examinations every year, 21 roads every two years, nine roads every three years, two roads every four years, 19 roads require re-examinations when it is deemed advisable, and especially upon promotion and after accidents and illness; three roads require re-examination on promotion only. Twenty-six roads require perfection and allow no concessions to old employees; 41 roads require perfection from new employees and allow various concessions to old employees, according to circumstances.

No road allows new applicants to wear glasses for distance in order to bring vision up to a normal standard; 74 roads allow old employees to wear glasses for distance; 12 roads do not allow glasses to be worn for distance at all.

The Ophthalmological Section adopted resolutions which are now well known.† These resolutions have been sent to every railroad in North America. Many roads which have never taken up this work at all have expressed a determination to put it into execution at once, and others that have been using inferior methods intend to use better.

There are a few important points of difference between the report of the committee adopted by the Ophthalmological Section and that adopted by the House of Delegates of the American Medical Association. The Ophthalmological Section felt that it did not wish to draw the lines too hard upon the railroads, and therefore voted that if the first or entrance examinations were made by the company's eye and ear surgeon, the subsequent examinations might with reasonable safety be left with the company surgeons, with the understanding that doubtful cases would be referred to the eye and ear surgeon.

Section 3 of the Ophthalmological Section report corresponds with Section 8 of the House of Delegates report, and I regard one feature of the latter report superior to the former, viz.: the clause which refers to the interchangeableness of positions from one road to another. A man who has undergone primary examinations on one road and has been accepted and placed at work, should be able to go to work for another road whose physical requirements are essentially similar, without losing the benefits of his time privileges.

I find no reference whatever in the House of Delegates

*Abstract of a paper by Frank Allport, M. D., read before the American Medical Association, Oct. 2, 1903.

†The committee report of the American Ophthalmological Association was printed in the *Railroad Gazette*, Sept. 20, 1901.

report concerning the requirements for color sense except as found in Section 6, which contains nothing of an obligatory or mandatory character. The only explanation for this omission is of course the presumption that it is an oversight and I should recommend that a clause be inserted in Section 5 (in the House of Delegates report), requiring perfect color sense.

Under Section 5, House of Delegates report, class A employees must possess a vision of $^{20}/_{30}$ with both eyes open, without glasses. "Each eye should also be tested separately and the vision of each noted." This opens a wide avenue of discussion. The report of the Ophthalmological Section concerning this same point, says that "employees enumerated in class A shall not be retained in such positions if vision sinks below $^{20}/_{30}$ in one eye and $^{20}/_{40}$ in the other." In other words, a reasonable standard is required of each eye.

I cannot endorse the idea of testing with both eyes open, and of ignoring the condition of a man's worst eye. We must be liberal in our concessions to old employees. A large proportion of old engineers have poor vision. As a man gets older he also usually gets more experience and good judgment, and what he lacks in vision and other physical conditions he makes up in other qualities, nearly if not quite as valuable. I do not recommend the same degree of latitude for firemen that I do for engineers. Firemen are usually young men and have not had the experience and do not possess the ripe judgment of engineers. They should, of course, possess perfect eyes before they become firemen, and this same standard or a very small departure from it, should obtain when their re-examination for promotion as engineer occurs. After they have become engineers, they are entitled to the latitude already referred to. I sometimes feel that the visual requirements of engineers should be graduated from time to time in accordance with their age and years of service, but this solution of the problem complicates a situation which we are endeavoring to simplify. It therefore seems best to state what we believe to be the extreme limits of visual safety for old engineers in the requirements, and then trust in the good judgment of the company surgeon or oculist to settle each case without indulging in hair-splitting technicalities.

A large proportion of engineers past 55 years of age would fail in a strict visual test for distance, unless they used glasses. This means that at the very time when engineers are most valuable to a railroad they must be discharged, because their vision has fallen one point below a prescribed theoretical standard, and although glasses can perhaps give them perfectly normal vision on both sides, they may not be worn. I understand all of the arguments against the use of glasses, they become misty on cold and foggy days, sweaty on hot days, and speckled with dirt and cinders. I question very much whether we have the right to enforce requirements of overpowering character upon old engineers at the present time. No strict requirements were in force years ago when these men were admitted to work. They were accepted with but little ceremony, and now they have grown old in the service, and should be dealt with as leniently as is consistent with safety. But new firemen, who, notwithstanding they possess a vision of $^{20}/_{20}$ in each eye, yet have an apparent substantial hypermetropia of, say, 1½ diopters, should not be accepted. Although this is easily overcome in young life by an active ciliary muscle, it shows itself unmistakably as age advances, and as the muscle loses its power.

Another phase of the matter which cannot be ignored is the labor problem. The removal of a single man, even though he is merely taken from one job and given another, is perhaps sufficient to tie up an entire railroad system. It is well to be sure we are on safe grounds when we remove a good engineer.

I recommend that the House of Delegates' report be further amended by inserting under "Class A" and also under the caption "Entrance to service or promotion" and after the words "$^{20}/_{20}$ in each eye, tested separately without glasses," the words "The applicant shall not possess more than 1½ diopters of apparent hypermetropia."*

Under the heading of Class A, "Re-examination," the testing with both eyes open should be done away with as inaccurate, misleading and unscientific. I recommend that "enginemen shall not be retained in their positions if vision sinks below $^{20}/_{40}$ in one eye and $^{20}/_{50}$ in the other, or $^{20}/_{30}$ in one eye and $^{20}/_{70}$ in the other. Distance glasses must be worn when on duty provided such glasses are necessary in order to bring vision up to the required standard. Extreme indulgence and concessions shall only be made to old and trusted enginemen, at the discretion of the company surgeon, it being remembered that the best vision is desirable and that glasses are undesirable. Firemen shall not be eligible for promotion to enginemen if vision sinks below $^{20}/_{30}$ in either eye without glasses, and shall not be retained as firemen if vision sinks below $^{20}/_{30}$ in one eye and $^{20}/_{40}$ in the other. The whispered voice must be heard at not less than 15 ft. in a quiet room."

Under the heading of Class B "Re-examinations of those in the service," instead of the words "$^{20}/_{40}$ with both eyes open, etc.," I suggest the words "Employees shall not be retained in these positions if vision sinks below $^{20}/_{40}$ in one eye and $^{20}/_{50}$ in the other eye, or $^{20}/_{30}$ in one eye and $^{20}/_{70}$ in the other. Glasses must be worn if they are necessary to secure adequate vision. The whispered voice must be heard at not less than 10 ft. in a quiet room." I suggest the same words in the same section of both Class C and Class D. I recommend striking out entirely Section 7.

*If the applicant can have a 1.00 diopter lens placed in front of each eye (separately tested) without blurring his vision, he has one diopter of apparent hypermetropia. If a + 1.25 or a + 1.50 diopter lens does not blur his vision, he has more than one diopter of apparent hypermetropia.

All-Electric Interlocking at Chillicothe, Ill.

The Atchison, Topeka & Santa Fe has contracted with the Taylor Signal Company for electric switch and signal apparatus at the drawbridge over Illinois River, at Chillicothe, Ill. The machine is to have six levers, to work two home signals, two distant signals, two derailing switches and one bridge lock. The railroad is single-track.

The bridge locking will be accomplished by applying a plunger to the operating lever of the engine, which will lock it in a central or non-operative position until all the interlocking levers are in the normal position, when the lever operating the lock will be released, allowing the bridge tender to apply power to a solenoid and withdraw the plunger. Reciprocally the indication on the lever operating the bridge lock will be controlled by circuit breakers on the lock plunger and at the ends of the draw which will only be closed when the operating lever is locked, draw in place and the rails safe to run over. Additional protection will be afforded by controlling the main battery through the same channels so that improper movements cannot be made by plugging the levers.

Track circuits will be provided through the entire limits of the plant to serve in the place of detector bars and to set signals at "stop" behind trains. A circuit will also be provided which will prevent the bridge tender opening a derail after a train has passed the distant signal; but he will be free to close a derail under any conditions. The drawbridge approaches and the signals will be lighted by electric lights. Power will be obtained from a 75 A H storage battery which will be charged from a 1 k.w. generator driven by a 2½ h.p. gasoline engine.

The estimated cost of this interlocking is a little over $3,000.

Foreign Railroad Notes.

The traffic on the Paris Metropolitan Railroad after the fearful accident last August fell off from an average of 260,000 daily just before the accident to 130,000 immediately after it.

It is reported that the Negus of Abyssinia has granted the French Ethiopian Railroad Co. a concession for 125 miles of railroad in the Anasch valley, said to be the paradise of Abyssinia.

Oct. 1 last there were 2,104 miles of electric railroad in Germany with 3,200 miles of track, in 125 different places. These were served by 12,352 motor cars and 7,967 trailers. Nearly all the old street railroads had adopted electricity.

The third section of the Jungfrau Railroad was opened June 28, extending wholly through a tunnel in limestone rock, from Rothstock to Eizerwand, which latter is 9,445 ft. above the sea. It is affirmed that capital is already provided for a further extension to Eismeer.

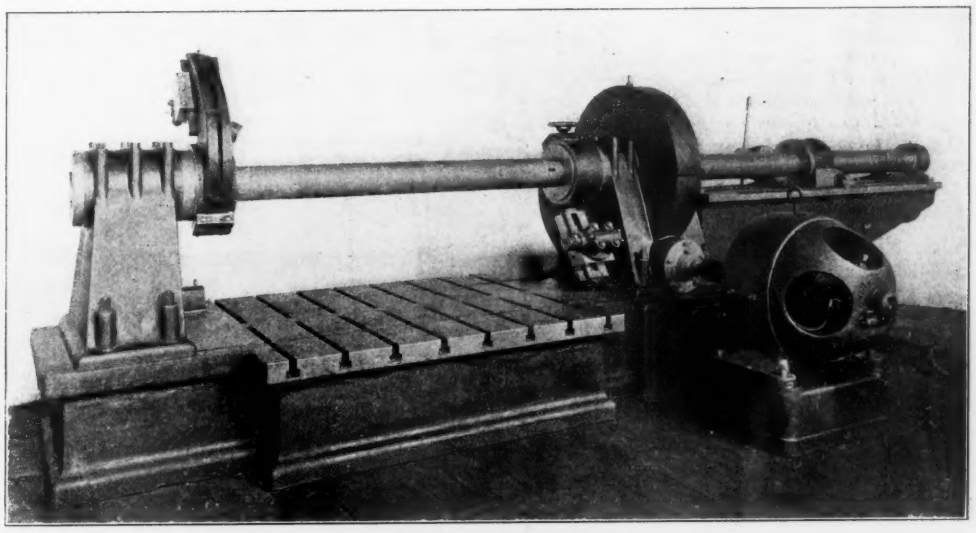
The great electric manufacturing companies have for a long time pressed the management of the State Railroads to permit them to equip certain suburban sections of the railroads out of Berlin with an electrical equipment, and Aug. 15 last the running of electric trains began on one section. Very much is hoped from the experiment. It is claimed that power can be provided at one station for the suburban sections of all the Berlin railroads, and at less cost than by locomotives.

In August the excavation of the Simplon Tunnel from the south penetrated a spring delivering more than 20 gallons per second of water of a temperature of 104 deg., which so warmed the air as to make work very difficult, until refrigerating apparatus was provided. The old spring, which for some time interrupted the work at that end of the tunnel, is now delivering about 375 gallons per second. The extension in July was 713 ft. at the north end and 575 ft. at the south end. The number of men at work was 3,141. Work was suspended at the north end 39 hours during the month on account of high water in the Rhone.

A Motor-Driven Horizontal Boring Machine.

A simple and successful arrangement of applying individual motor drive to a horizontal boring machine is shown in the accompanying illustration. The tool is a Barret No. 3, similar in all particulars to the belt-driven style, except that the cone pulley is replaced by a Crocker-Wheeler 13-h.p. motor mounted on a special cast-iron base which is bolted to the bed of the machine proper. Over all, the equipment occupies a floor space 18 ft. 1½ in. long, exclusive of the projection of the boring bar, by 7 ft. 4 in. wide. The boring bar is 6 in. in diameter and 16 ft. 8 in. long, and is made of hammered steel. An Albro worm and worm-gear with a ratio of 70 to 1 transmits the power, affording a smooth and even motion to the boring bar, particularly desirable in cylinder boring and work of a similar character. The worm and worm-gear are encased in one casting, which protects the gears and confines the lubricant with the assistance of a stuffing box surrounding the worm shaft.

The bearings in the pedestals supporting the boring bar have their centers 24 in. from the surface of the bed and are bored out 9 in. in diameter. Each bearing contains a sleeve, the one in the tail pedestal being 23 in. long, and the other, which forms the hub of the worm wheel being 30½ in. long. These sleeves are fixed against endwise displacement but are provided with feathers which engage the keyway extending the length of the splined boring bar so as to cause all to rotate simultaneously. On extensions of the sleeves between the pedestals are mounted arms which carry facing blocks. The latter support the facing tools and are arranged to feed axially or at right angles thereto by the turning of star shaped hand-wheels. To make the feed automatic, tripping blocks may be fastened to the bed and set so as to revolve the screws one-fifth of a turn at each revolution of the boring bar.



Barrett Horizontal Boring Machine with Individual Motor.

For inside boring a cutting head, not shown in the illustration, is secured to the boring bar, the feeding being accomplished by sliding the whole bar endwise. The extended frame at the right of the machine, with a third bearing at its outer end, adds to the rigidity of the bar and supports the feeding mechanism. This consists of a sliding carriage containing a sleeve that revolves with the boring bar, and which may be secured to it at any point. Any shifting of the carriage causes a lengthwise movement of the boring bar. A pinion on the carriage engages a rack on the frame, allowing direct hand feeding, and there is also a system for automatic feeding much the same as that commonly used on lathes. By this arrangement the bar can be handled very rapidly, and, it is claimed, as easily as a carriage of any 30-in. lathe. The machine has a continuous feed travel of 48 in. in either direction and will bore and face both ends of a cylinder at the same time.

With but the one speed reduction the machine is capable of 12 speeds in either direction varying from $2^2/_7$ to $15^1/_7$ r.p.m., obtained by altering the speed of the motor. The latter is equipped with the Crocker-Wheeler system of multiple voltage current supply, giving six fundamental speeds by distinct voltages increasing by increments of 40 from 0 to 240 volts, and six intermediate speeds secured through the use of a small resistance between each fundamental step.

The Barrett boring machine is built by the Meadville Vise Company, Meadville, Pa., and the motor is the regular semi-inclosed type, size 10-I, shunt-wound, of the Crocker-Wheeler Company, Ampere, N. J.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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The Department of Tests at Altoona will soon issue a preliminary announcement of the plans of the Pennsylvania Railroad Company for locomotive testing at St. Louis. While as yet nothing has been given out for publication, it is understood that there will be tested not less than 12 locomotives, five of which will probably be of foreign make. The schedule of tests will allow from 12 to 20 working days for each locomotive tested, the longer period being allotted to those engines which are to come early in the series when the apparatus and men are new to their work. It is understood, also, that the outline covering the tests to which individual locomotives are to be subjected will be such as to perfectly define the performance of the whole machine under all of the conditions common to service. For example, having chosen a given speed, tests will be run under a full throttle at different cut-offs until the longest cut-off is found for which the boiler will supply steam, after which another speed will be chosen, and the same process repeated. Tests will also be made at longer-cut-offs in connection with a partly closed throttle, and also under starting conditions. The Pennsylvania intends to give the widest possible publicity to the results of the tests, and it is said that the bulletin which is soon to be issued will define the number and nature of the publications which are to follow it. The forthcoming bulletin will be an important document.

Why Steel and Its Erection Costs So Much.

On Thursday, September 24, at noon, an interested audience gathered in the office of the Bridge Commissioner of the City of New York to hear the results of the bidding for about 40,000 tons of steel for the superstructure of the Blackwell's Island bridge over the East River. It was confidently expected that at least four American and one English firm would be found able and willing to undertake the contract, but when the sealed box was opened, only one bid was found. Nor was this the only disappointment of that hour, for when this bid was examined the price was found to be $1,700,000 more than the supposedly liberal estimate made by the Commissioner. This discrepancy between estimate and bid was as startling and unexpected as the unaccountable absence of bids from some of the largest contracting companies. The specifications called for 4,500 tons of nickel steel eyebars and pins, 3,200 tons of structural steel eyebars and pins and 35,000 tons of structural steel other than eyebars, and the prices bid were 8.3 cents, 6.05 cents and 5.91 cents a pound respectively, in place and erected, bringing the total cost up to $5,255,514, as against the amount appropriated by the Board of Aldermen on the Commissioner's estimate of three and a half millions. The fact that only one bid was made, and this so much higher than the estimate, led the bitterly disappointed Commissioner to say at the time, somewhat rashly, that there was collusion among the companies who were expected to bid. His sober second thought seems not to have dispelled this belief. So far as we are concerned, that phase of the incident is disposed of by as absolute information as the case admits, that positively there was no collusion. The fact that some of the companies did not make bids and that the one bid which was made was so much higher than was expected, was due to other and more obscure causes. There are, as set down in the general plans and specifications for this bridge, a number of departures from any previous practice. Conditions entirely apart from the engineering details of the work had a direct effect on the preliminary and final estimates of the one bidder and of the other companies which decided not to bid. The plans provide for the longest cantilever span in this country, 1,182 ft., and the whole construction of the bridge is correspondingly heavy. The Commissioner planned to use 18-inch nickel steel eyebars for the top chords. This is the first time that nickel steel has been specified for bridge parts of this size, and these are also by far the largest eyebars ever designed. The Commissioner, in his well-meant efforts to obtain satisfactory and uniform material, laid down in his specifications, rigid tests based on experiments made for him by experts, and felt confident that bars could and should be made to pass these tests. The making of an 18-inch eyebar is pioneering, and it is a notable advance in bridge engineering, if it can be economically done; and while the steel makers could perhaps successfully produce such a bar, they have absolutely no means of knowing what the cost would be. Some of the concerns which were expected to bid would have been obliged to erect new machinery to make the heads on such large bars, and this would entail an additional cost, which would necessarily have to be allowed for in making the price on this contract, though it is probable that two or three plants are already fitted equal to this work. This would not, therefore, fully account for the discrepancy between the estimated price of nickel steel at 6 cents and the bid of 8.3 cents.

The time allowed for the completion of the work is a little more than two years. Inasmuch as so many of the details of this bridge are new and heretofore untried, and the work is of such magnitude, it is quite likely that the short time prevented some bidding. The time necessary for making satisfactory experiments on the practical production of 18-inch eyebars of nickel steel has been variously estimated at from four months to a year. The latter guess is probably more nearly correct, and deducting this time from the allowed time for completion leaves a small margin for such a tremendous undertaking.

The price bid for structural steel eyebars and pins is but little more than the bid for other structural steel, and it is the high bid for this latter material which swells the total cost to more than a million dollars above the appropriation. There can be but one explanation of this high price, and that is that it includes the erection of by far the greater part of the material in the bridge. The cost of erection has evidently been the determining factor in making this price. A contract was recently let in New York City for 30,000 tons of heavy structural steel at 2½ cents a pound delivered, but not erected. Under ordinary conditions of locality and labor supply, the usual rough estimate of erecting cost on such work is about 1¼ cents a pound. If this erection cost is added to the cost of the material in the contract cited, the cost of the work erected would be 3¾ cents a pound, as against 5.9 cents, bid on the Blackwell's Island bridge.

The demoralization of the building trades in New York is notorious. The walking delegate still has the contractor at his mercy, and it is not possible at present to put up a large building or any other structure with any assurance of its being completed on time. As one man put it, "I would not dare to undertake a contract as long as Sam Parks is out of jail." There is no strike clause in the contract for this bridge, and any delay due to a strike would fall on the contractor. As long as the labor conditions remain as unsettled as they are, the acceptance of such a contract as this involves risks which must necessarily be provided for in naming a price. Another factor which affects the cost of erection is the unusually large size of a number of pieces in the superstructure, some of which weigh more than 100 tons. The erection of these large pieces, the shipment and transfer by lighter to the ground, involves the use of appliances heavier than have heretofore been used, which must be built especially for this job. The risk in handling such parts and the excessive cost of lighterage on the larger pieces probably had something to do with the price asked.

The uncertainty of the political situation may have some indirect bearing on the bid, but this is doubtful. The whole question resolves itself into a simple statement of fact: The Commissioner guessed at the probable cost, and guessed too low. The companies which did not bid were probably influenced by the conditions discussed above, and the company which did bid, named its price after carefully considering all phases of the question. This is not by any means the first time that an estimate was far exceeded by the bid. Only recently a bridge in Pelham Park was to be built, and the estimates of the engineer and the experts employed by him, tallied almost exactly at $300,000, and an additional $50,000 was added to this for a safe margin, but when the lowest bid was opened it was found to be $500,000. Unquestionably the labor conditions swelled this bid.

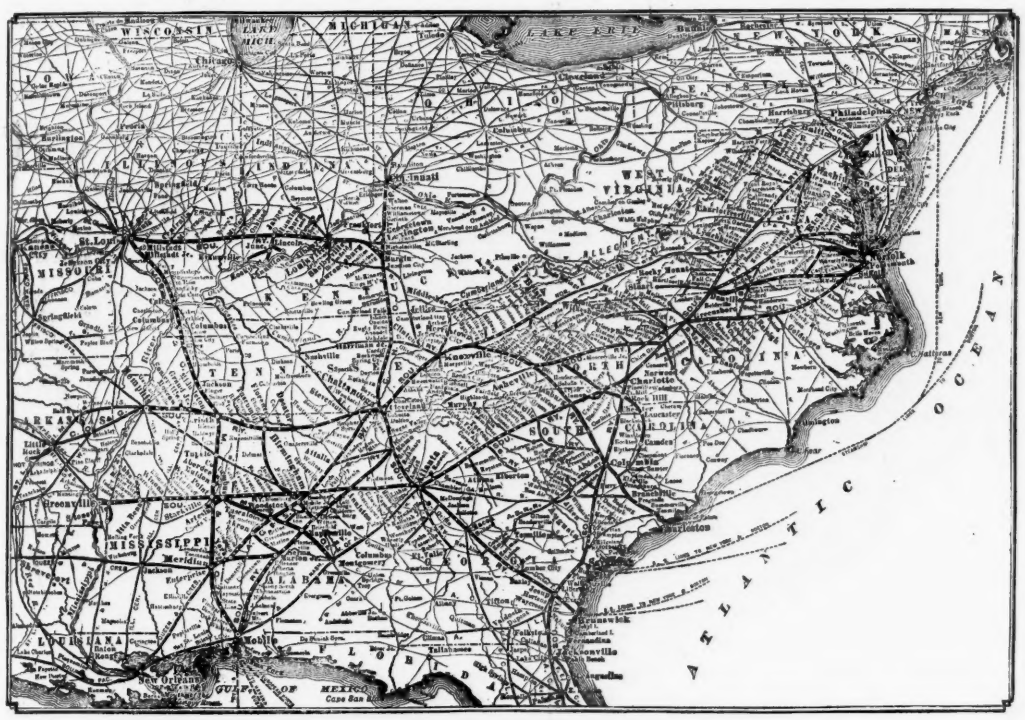
The Commissioner will probably modify the specifications for the Blackwell's Island bridge and readvertise for bids. If successful in obtaining a bid within the appropriation, or an additional appropriation covering the lowest bid, the bridge will probably be started at once. The unexpected turn in the bidding for the Blackwell's Island bridge is a setback to the Commissioner's plans for an eyebar suspension bridge over the river at site No. 3. Had a number of tenders been made for the nickel steel eyebars in this bridge, it is quite possible that little opposition would have been encountered in obtaining the appropriation for eyebar suspension chains in Bridge No. 3.

Southern Railway.

The report for the year ending June 30 shows continued prosperity, with gross earnings of $42,354,060, as against $37,712,248, in 1902, an increase of $4,641,812. Operating expenses and taxes, however, increased from $26,846,837 to $30,989,140; the increase being chiefly caused by increased cost of conducting transportation, although approximately 1¼ million dollars was paid for maintenance of equipment in excess of the amount paid last year. Net income from operation still shows a gain, however, and amounted to $11,364,920, which was augmented by income from other sources to a total of $12,576,181 as against $11,689,920 last year. After deducting interest, rentals, etc., there remained a balance of $3,707,477 as against $3,600,897 last year, out of which $1,500,000, constituting a 2½ per cent. dividend, was paid on the preferred stock last April and a like amount was reserved to pay the fall dividend, the balance ultimately carried forward to credit of profit and loss amounting to $707,477. It will be recollected that the voting trust organized in 1894, coincidently with the formation of the present company, would have expired previous to the annual meeting last fall, owing to the payment of the 5 per cent. dividends on the preferred stock by which the trust was to be terminated, had not that dividend been deferred until after the meeting. By vote of a majority of stock trust certificates, this voting trust has now been extended until October, 1907. J. P. Morgan, Charles Lanier and G. F. Baker are the voting trustees.

The most striking feature about the Southern report is the large growth of gross earnings in recent years in contrast to the small increase in balance carried to profit and loss. In 1897, with 4,827 miles of road worked, gross earnings were $19,079,490, and $445,920 was carried forward as profit balance, without payment of dividend. The mileage worked during the current year amounted to 7,129, an increase of 46 per cent., and gross earnings, as stated above, were over 42½ millions, an increase of about 122 per cent.; yet, after deduction of $3,000,000 for dividends, less than three-quarters of a million was carried forward. Although the showing on first appearance is not especially good, further study of the report brings out the evident opportunity the system has for development, and it seems reasonable to expect that when several of the properties recently allied, such as the Mobile & Ohio and the Chicago, Indianapolis & Louisville (half share with the Louisville & Nashville) are brought up to a higher state of efficiency, considerable gains in net can readily be shown. At present, the interest on the securities issued in payment for these two last-named properties considerably exceeds the dividends received from them. The Southern common stock outstanding amounts to $120,000,000, and the present margin of profit from operation would seem to afford little hope of a dividend in the near future, and yet it is perfectly possible that the reverse may be true in a comparatively short time with continuance of the large gains in gross and better efficiency obtained in the working of the subsidiary properties. The policy in regard to paying for betterment work out of earnings has been liberal, and although the charge per mile for maintenance of way and structures is small compared with that on many of the larger systems in this country, the character of the lines and traffic is such that this is to be expected, the general average including a large amount of mileage in thinly populated territory where traffic is light. The charge for maintenance of way figures out about $861 per mile, with average freight earnings of $3,939 per mile. The freight

train loading stands at approximately 193 tons, a slight decrease from last year, and it is evident that there is room for considerable improvement here, particularly in view of the large bituminous coal business done. The average number of tons of freight in each loaded car during the past year was a trifle over 16, and the average number of tons of revenue freight was slightly less than 14 to a car. In the last six years the amount of coal, coke, ore, etc., hauled, has increased from 2,676,459 tons in 1897 to 8,251,240 tons for the current year, and the percentage of this class of freight to the total tonnage has risen from 40 to nearly 42, so that it is certainly



Southern Railway.

reasonable to expect early increases in average train load.

It is interesting to observe the large gains which have been made in miscellaneous manufactures hauled and in agricultural products, indicating the work the road has done as a developer of that portion of the South through which it passes. Products of agriculture have nearly doubled in the last six years, the increases occurring quite evenly throughout the dozen or so items specified, and the tonnage of manufactured articles has increased 120 per cent. during the same period, indicating a permanent basis for future prosperity. There is also a large increase in the amount of lumber hauled, the tonnage of lumber and logs in 1903 being about four times the tonnage in 1897, but a crop of this sort is, of course, a less permanent asset to a road than an increase in mines and manufactures.

During the year 16,744 tons of new 75-lb. rails were laid and 17,460 tons of new 80-lb. rails, amounting to about 281 miles, as compared with 202 miles of heavy rails laid the year previous. There are now over a thousand miles of 80-lb. rails in the lines owned, controlled and operated, as against 156 miles six years ago, and there are 738 miles of 75-lb. rails as against 330 miles in 1897. But there still remains 2,395 miles of line laid with rail weighing 56 lbs. and less, of which a fairly large proportion has been acquired with lines taken over during the period. It is evident, therefore, that there is much work still to be done that ought to be charged to operation, before the lines are in first class shape, for 56-lb. rails are an indication that other things besides superstructure are likely soon to need attention. The charge for maintenance of equipment during the past year was $6,916,823, as against $5,669,422 in 1902, and the expenditure for repairs and renewals of locomotives increased from 5.6 cents to 7.7 cents per mile run. There was also a considerable increase in the cost of fuel and of wages. The average number of locomotives in service at the close of the fiscal year was 972, an increase of 40 over last year.

The joint purchase of the Monon, previously referred to, was provided for by the issue of $11,788,642. Louisville & Nashville-Southern-Monon collateral joint 4 per cent. bonds. Although the dividends received on this stock amounted to about $35,000 less than the Southern's proportion of interest on the new bonds, attention is called to the fact that the Monon earnings applicable to common stock dividends were considerable in excess of the 2½ per cent. paid. On July 1, 1902, the Southern also took possession of the Carolina Division, under lease. This is a consolidation of the Asheville & Spartanburg, the Carolina Midland, the South Carolina & Georgia, and other short railroads. Under an agreement with the Atlantic Coast Line for a period of 50 years, the Southern's through trains, both freight and passenger, are now run from Savannah and Jesup, Ga., to Jacksonville, with a supplemental agreement for an exchange of traffic between the Southern and the Atlantic Coast lines south of Jacksonville; and by means of this extension, a direct connection with the Florida East Coast was also provided. The St. John's River Terminal and the Atlantic, Valdosta & Western securities were also purchased in July, 1902, adding about 110 miles of line and important freight terminals at Jacksonville. The Southern also bought the outstanding first mortgage bonds on the entire capital of the New Orleans Belt & Terminal Company, which owns the Port Chalmette terminals on the Mississippi below New Orleans and a belt railroad connecting railroads entering the city. All of these properties are likely to prove valuable when operated harmoniously with the rest of the system, though at present they contribute unfavorably to the expense account, in comparison with the receipts they bring in.

To sum up, therefore, the Southern appears by careful and progressive work to have reached a position where it is likely that net earnings will, in the future, increase in a better ratio to the growth of traffic than in past years. The system is still young, not only in point of organization but of development, and it is evident that its earning power is great. It would seem that the process of welding together the numerous crude and unprofitable lines in poor sections of the country was well along on the road to completion and that the building up of the territory reached is progressing very favorably, as indicated by the increased tonnage in manufacturing and agricultural products.

Chicago, Milwaukee & St Paul.

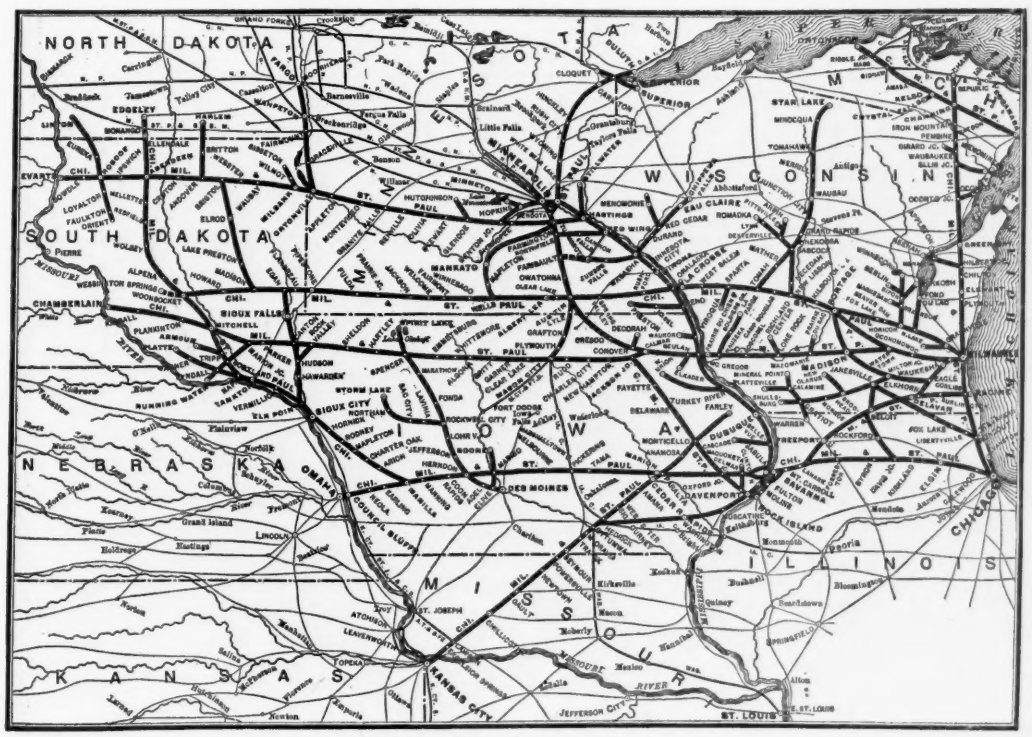
Another good year is reported, both in gross earnings and in net, continuing the steady increases since 1897. Gross earnings for the current year amounted to $47,662,737, as compared with $45,613,125 last year, and $42,369,012 in 1901, and, after the deduction of operating expenses and fixed charges, a balance remains of $10,473,259, from the results of the year's business. This would have sufficed to pay a dividend of 7 per cent. on the preferred stock—as was done—and of about 12 per cent. on the common stock; and this is after a liberal charge to operating expenses for maintenance of way and of equipment, maintenance of way and structures having been charged $7,347,048, which is at the rate of over $1,100 a mile, and maintenance of equipment having been charged nearly $4,000,000. The expenses under these two accounts amounted to over 35 per cent. of the total expenses for the year, and include such items as $1,282,180 for bridges and culverts and $268,424 to replace the loss of equipment.

The common stock dividend was only increased one-half of 1 per cent., however, making the dividend on this class of stock 7½ per cent., as against 7 per cent. since September, 1902; 6 per cent. from March, 1901; 5 per cent. in 1898, 1899, and 1900; 4 per cent. in 1896, and 2 per cent. in 1895. Of the remainder of the surplus earnings available for dividend purposes, had it been so desired, over $1,000,000 was appropriated for the renewal and improvement account. The amount credited to this fund to June 30, 1903, with interest received on balances, amounted to $10,351,324, and out of it $952,368 has been spent on track elevation, almost 2½ millions for grade reductions and general improvements of the line, and over $600,000 for bridge replacement, with other items of generous proportions, charged in this way to operating expenses. The unexpended balance of the fund now stands at $5,050,264 as against $4,680,229 last year.

The funded debt of the company has been increased during the fiscal year by the issue of 133 general mortgage bonds, against which there is a decrease of $1,175,000 bonds retired and cancelled, so that the effect of the changes has been to reduce the funded debt to $123,754,500, which is at the very low rate of $18,519 per mile of road, on which the interest charge per mile is $942.17. The bonds retired during the year, however, were converted into preferred stock. In fact, this bond conversion has occasioned almost all the increases in preferred stock since 1873, and this class of stock now stands at $47,724,500, receiving 7 per cent. annually. The amount of both classes of capital stock per mile of road is less than the funded debt, however, standing at $15,848.44, and the total capitalization of the company per mile is well under $35,000.

Capital expenditure during the year amounted to $8,568,924, of which somewhat over two million was spent for equipment, other than that charged to working expenses; nearly four million was spent for new lines and second main track, and the balance used mainly for securities of railroads and coal companies acquired. New construction during the year includes the completion of a line from Ashdale to Ebner, Ill., 15 miles; from Eureka, S. Dak., to Linton, N. Dak., 49 miles, and from Farmington to Mankato, Minn., 55 miles. A line from Muscatine to Rutledge, Iowa, 76 miles, was opened Sept. 1. In connection with the right to joint use of the lines of other companies between East Moline, Ill., and Muscatine, Iowa, a portion of these extensions constitute a cut-off which will effect a reduction of 32 miles distance between Chicago and Kansas City. Ninety miles of second main track building during the year on the La Crosse Division have also been completed at the present time. Owing to the scarcity of labor and the excessive cost of the work, the remaining 92 miles will not be double-tracked at present.

Over half a million has also been spent on shop improvement and extension during the year, about $79,000 of which was charged to operation and the renewal and improvement fund. Other shop additions and improve-



Chicago, Milwaukee & St. Paul.

ments have been authorized, with a view to enabling the company to build at least 50 locomotives each year at its West Milwaukee shops, at a saving of over $3,000 each, on present prices.

The total tonnage of agricultural products moved remains practically unchanged from last year. There was a gain in minerals, manufactures and forest products, however, which reduced the percentage of grain, etc., to 23.1 per cent. of the total freight, as against 24.8 per cent. last year. Bituminous coal shows the largest gain, with an increase from 1,706,289 tons to 2,280,652 tons, as against a loss of 191,530 tons in anthracite. Wheat decreased 115,506 tons and corn 168,207, as against an increase of 140,663 tons in oats. Train load shows a decrease from the rapid advances of recent years, the average being 244 tons, while in 1902 it was 10 tons greater. But the present figure is considerably in excess of that for any year except 1902. The development of the train load since 1896 is shown in the following table:

Year.	Tons.	Year	Tons.
1896	167.1	1900	209.1
1897	167.0	1901	236.5
1898	177.9	1902	254.2
1899	189.8	1903	244.2

A recapitulation of some of the most important statistics of operation for 1903 as compared with 1902, is given below:

Freight earnings	$34,797,045	$33,516,812
Passengers, mails, etc.	12,865,692	12,096,312
Total gross	$47,662,737	$45,613,124
Main. of way and structure	7,347,048	7,219,136
Maintenance of equipment	3,893,834	3,363,595
Conducting transportation	16,829,796	14,881,635
Total expenses	$31,598,174	$30,196,895
Net earnings	16,064,563	15,416,239

Proposed Passenger Fare Reform in Sweden.

A commission has been engaged for the last five years in studying the passenger traffic of the Swedish State Railroads and devising a new system of rates, and has just made its report. Sweden is not a very large country (173,000 square miles—a little larger than California), but it is a very long one, as may be known by the fact that it has one railroad line 1,340 miles long. It has a population of something more than five millions, mostly in a plain country, and most of it not far from a harbor. It has few large towns, and these at considerable distances from each other. The committee has endeavored to make not a general solution of the passenger-rate problem, but one fitted for the peculiar circumstances of Sweden. Nevertheless, it has given special attention to the elements of cost of passenger traffic—a dark subject. These it divides into those which are independent of the length of the journey, but increase with the number of journeys, those which increase in the same proportion as the length of the journeys and those which are unaffected by either. It applies its conclusions to the passenger traffic of 1901, and assumes to state approximately the cost of journeys of different lengths.

The fares in Sweden have been on a basis of 4 öre for the third class, 6 for the second, and 8½ for the first per kilometer, which is equivalent to 1.724, 2.586 and 3.663 cents per mile. But a very large proportion of the traffic is carried at round-trip and other reduced rates, and the actual average receipt per passenger-mile in 1901 was only 1.344 cents. There is little suburban traffic. Stockholm, with its 302,000 inhabitants, is on an archipelago, with steamboat connections all around; there is but one other town of more than 100,000 inhabitants, and only two places of more than 5,000 inhabitants which have no harbor. The commission finds that there is little to be expected from efforts to develop the traffic for short distances. The larger towns are considerable distances apart from each other, and the average railroad journey is long for a European country, 26 miles, against less than 12½ in Germany, and 28½ in the United States.

Under these circumstances the commission believes that the part of the passenger traffic which may be developed with most success is that for considerable distances, and it supports its conclusions by the experience of Finland, where a reduction of 20 per cent. in the rates for long distances was followed by an increase of 60 per cent. in the travel.

For distances of 100 kilometers (62 miles) or less, the average rate in 1901 was about 1.2 cents per mile. This is considered to be low enough, but it is proposed to reduce it about 3 per cent. The calculations of the committee are that a reduction to 2 öre (instead of 2.7) per kilometer would make necessary an increase of no less than 770 per cent. in the travel to yield the same profit as in 1901!

The chief field for change is found in distances of 300 to 700 kilometers (186 to 735 miles), which at present yield about one-fifth of the total passenger earnings. The commission estimates that for these distances a decrease of 10 per cent. in the fares would be covered by an increase of 21 per cent. in the travel; a decrease of 20 per cent. in the fares would be made good by an increase of 54 per cent. in the travel, and that 110 per cent. increase in travel would be required to make good a decrease of 30 per cent. in the fares for these distances. It ventures to recommend a reduction of about 20 per cent.

There is but little travel over distances of more than 700 kilometers, and for most of these a special rate has already been provided. The recommendations of the commission are:

That the rates for the different classes be in the proportion of 2 for the third class, 3 for the second, and 5 for the first class.

That a zone system be adopted in which the zones are short, and increase moderately with the distance.

That the extra charge for express trains (which is general on the continent of Europe) be a fixed sum, whatever the distance traveled. This is a novelty in the history of rates.

Specifically, rates are to be 20, 30 and 50 öre (5⅜, 8 and 13⅜ cents) per zone for the three classes in ordinary passenger trains.

The zones are 8 kilometers (5 miles) each for the first 12, 9 kilometers for the following 12, and so on, increasing in length after each 12 zones. Thus for a distance of 1,500 kilometers, which is about equal to the distance from New York to Chicago,

12 zones = 96 kilometers.	12 zones = 156 kilometers.
12 zones = 108 kilometers.	12 zones = 168 kilometers.
12 zones = 120 kilometers.	12 zones = 180 kilometers.
12 zones = 132 kilometers.	12 zones = 192 kilometers.
12 zones = 144 kilometers.	12 zones = 204 kilometers.

or 120 zones in all, with fares of 240, 360 and 600 öre for the three classes respectively = $6.43, $9.64 and $16.07.

As for these longer distances it would be almost necessary to resort to the express trains, the additional charges for these, uniform for all distances, but in the same proportion as the fares for the different classes, should be added, namely, 1, 1½ and 2½ crowns = 27, 40 and 67 cents, making the first class fare for 931 miles $16.74. For the 660 kilometers more of one, the very long journey, there would be but 35 zones more, costing an addition of $1.87, $2.81 and $4.68 respectively, or $21.42 first class for the journey of 1,340 miles to the Arctic Circle—about as far as from New York to St. Paul.

The uniform charge for express trains is intended to keep the short distance travel away from them.

With these fares it is proposed to abolish all round-trip tickets, but not commutation season tickets.

The effect would be to make journeys for 100 kilometers (62 miles) or less cost very nearly the same as for the present round-trip tickets; for greater distances much less.

The commission anticipates from the proposed tariff a large increase in travel for the longer distances, but on the whole no increase in net earnings, and at first some, but not an important, decrease. Its calculations seem very soberly made, and as it has taken five years for its task they certainly have been very deliberate. It must be remembered that this is so far only a proposal, not yet adopted. Its rationality, as in all such cases, must, of course, depend upon the local circumstances; but every serious study of this difficult subject deserves attention.

NEW PUBLICATIONS.

The Elasticity and Resistance of the Materials of Engineering. By Wm. H. Burr, C.E., Professor of Civil Engineering in Columbia University. New York: John Wiley & Sons. 1903. 8vo, 1,100 pages, illustrated. Cloth, $7.50.

This is the sixth edition, rewritten and enlarged. More than one-half is new matter, and much of it is original, and hitherto unpublished. The contents have been divided into two parts under the general headings, Analytical and Technical. There are also two appendices. Part I, comprising the first 260 pages, gives the theoretical treatment of all general cases of stresses in structural members. The last chapter treats of combined stress conditions, such as combined bending and torsion, combined bending and direct stress, much of which matter is largely new. In the technical treatment of the subject, Part II, in taking up wrought iron, the author alludes to its entire displacement as a structural material by the numerous grades of soft and mild steel. The many varieties of simple and alloyed steels, including manganese and nickel steel, are given extended consideration. Annealing, the effects of manipulation common to constructive processes, and of chemical elements on the physical qualities of steel are fully dealt with. The physical properties of other important metals, including copper, tin, aluminum and zinc, and also of cement, cement mortars, concrete, etc., are presented. An entire chapter is devoted to concrete-steel members, containing much new matter on this comparatively new form of construction. The theory and design of these members are treated at length, and practical applications of the formulæ given. Appendix I contains advanced analytic matter relating to the general theory of elasticity in amorphous solid bodies, and the exact theories of torsion and flexure. The last 80 pages of the book contain a full set of sections and tables of properties of structural shapes taken from the hand-book of the Cambria Steel Company. These will be of considerable practical value both to students and in structural practice.

Iron, Steel, and Other Alloys. By Henry M. Howe, Professor of Metallurgy, Columbia University. Boston: Sauveur & Whiting, 1903. Price $5.

This latest book by Prof. Howe is an able successor to his very complete treatise on "The Metallurgy of Steel." It deals with a subject comparatively new and little known, the metallography of iron and other alloys. The micro-structure of metals as an exact science dates back only a few years and yet in that time through the untiring efforts of a few men, among them the author of this work, many of the hitherto unexplained phenomena of changes in metals and alloys under different heat and mechanical treatments, have been rationally accounted for and knowledge of inestimable value given to the steel maker and the metallurgist for predetermining the nature of their product. Prof. Howe's book is a general treatment of the nature of alloys, particularly the alloys of iron and steel. It is both elementary and profound and covers the entire subject from the simplest conception of the nature of alloys to the most analytical examination of the reasons for the changes which occur during treatment. The first half of the volume is largely explanatory and covers the common alloys of metals other than iron, their cooling and freezing curves and the nature of their contents and combinations as derived from the curves. Iron and steel are similarly but more fully treated in the last half of the work. It is this portion of the book which is of greatest interest and value to engineers. A general survey of the processes of steel and iron making is also included. The book is illustrated with numerous diagrams, curves and reproductions from micro-photographs, many of the latter being from the author's own collection. There is an appendix on the constitution of gray cast iron, and an excellent index.

Governors and Governing Mechanism. By H. R. Hall. London: The Technical Publishing Company Limited, 1903. Price, two shillings, sixpence.

The opening chapters of this book describe the principles underlying the action of the steam engine governor. The qualifications a governor should possess are, power, sensitiveness, regularity, steadiness and lightness. The author's explanation of regularity is that the difference in speeds between any two equal intermediate positions within the total range of variation should be alike; a point to which he says very little attention has been paid by engineers, with the result that few governors possess this property, and are much less powerful with the same sensitiveness than if properly designed. For this same reason, the astatic or isochronous governor is not a governor, since it lacks this essential quality. All of the important forms of valve gear are described and methods given for designing the governors for them. The manner in which the essential qualities a governor should possess, enumerated above, affect certain well-known special forms of governors such as shaft, inertia, gas engine and relay governors, is shown. There are two appendices, the first of which is short and deals further with governor power. Appendix II gives numerous examples of governors and governing mechanism by well-known makers.

Practical Physics. By Professor Ervin S. Ferry, Purdue University, LaFayette, Ind. Published by the author. This book of 300 pages is designed as a handbook to be used as a guide in laboratory courses. While its description of apparatus and its outline of experiments all have a direct application to the Physical Laboratory of Purdue University, its comprehensive character will make it useful wherever students are to be directed in this kind of work. Part 1 deals with Fundamental Measurements and Properties of Matter: Part 2 with Heat. The latter part includes thermometry, expansion of solids and liquids, properties of gases and solutions, hygrometry, calorimetry, change of state, thermo-chemical measurements, heat conduction, and thermodynamics. The last named subject is introduced merely for the purpose of setting forth the relation between mechanical energy and heat. Typographically, the book is above criticism. It contains 120 illustrations, chiefly wax-process engravings, all of which were made especially for this volume. There are a few well selected tables, and the volume is satisfactory and commendable.

Engineering Preliminaries for an Interurban Electric Railway. By Ernest Gonzenbach. New York: McGraw Publishing Co., 1903. Price $1.

This little book of 71 pages is a brief outline of the preliminary steps to be taken in designing the most economical equipment and location for an electric interurban road. Each detail of the problem is taken up and the reasons for adopting it in the final design discussed pro and con. It reviews the question of interurban roads in a sane and rational manner, pointing out the mistakes which have been made and which may be made and on which depend the success or failure of the scheme. Overdoing heavy track and power house equipment for a traffic which does not warrant such expenditure is the one serious mistake to avoid. It is a significant fact that the author strongly recommends automatic signals, private right of way and a multiple-unit system of control, believing that all of these things are essential and more than repay their additional first cost and complication.

Specifications for Portland and Natural Cements. Published by the American Railway Engineering and Maintenance of Way Association. Chicago, 1903. Price 10 cents.

This pamphlet gives in full the specifications for Portland and natural cements as adopted this year. Specifications for concrete, submitted by the Committee on Masonry but not acted on by the convention for lack of time, are also included.

The Manufacture of Iron and Steel Tubes. By Edward C. R. Marks. Second and enlarged edition. London: The Technical Publishing Company Limited, 1903. Price 5 shillings.

The articles in this little book comprise a series of lectures delivered by the author to the Birmingham (England) Municipal Technical School. The history and development of the different processes of iron and steel tube-making as summarized from the patent specifications of the inventors are given. British practice naturally re-

ceives the most attention, although all important American and German processes for which British patents were taken, are described with impartial fullness. The number and date of each patent is given, and also its expiration, if it has become void. An appendix gives a list of British patent specifications, which has been revised and brought up to date.

TRADE CATALOGUES.

The Escalator is the subject of a leaflet by the Otis Elevator Co. Some of the installations in department stores have had wide steps for three persons, run at a rate to deliver 4,000 steps an hour at the landing, making a capacity of 12,000 passengers an hour. In practice, 6,000 an hour have been carried. The new narrow escalator carries but one passenger on each step and can deliver 4,000 an hour.

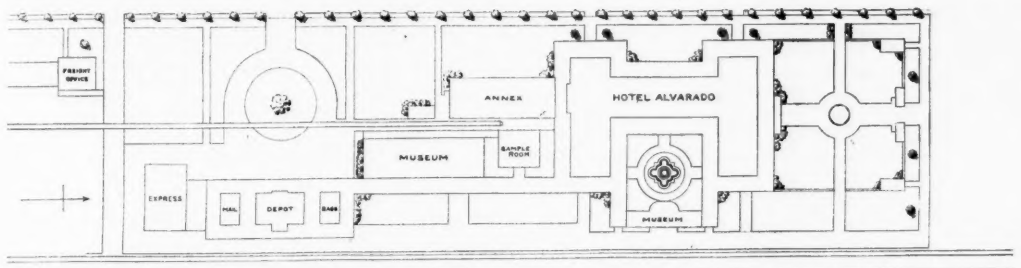
The Santa Fe Station Park at Albuquerque.

By A. REINISCH.

Consulting Landscape Gardener A., T. & S. F. R. R.

The station grounds at Albuquerque, N. Mex., cover an area of 4⅓ acres and stretch south along the track for over 800 ft., with a width of 235 ft. The pieces of lawn surrounding the buildings were sown to blue grass in the fall of last year; the planting of trees and shrubs was done in the spring of the present year. The high altitude—4,935 ft.—made it difficult to find suitable planting material, and great care was taken to select species that are known to do well in similar climates.

On the west line of the grounds a row of pink locust (Robinia Neo-Mexicana) was planted as a street tree for shading the sidewalk, and on the north end for the same purpose, the maiden hair tree (Salisburia adiantifolia). On each side of the two west entrances to the Hotel Alvarado are planted Colorado blue spruce (picea pungens). To cover the massive pillars of the colonnades and the low walls inclosing the north lawn the following vines were employed: Ampelopsis tricuspidata (Boston ivy); ampelopsis Virginica (Virginia creeper); ampelopsis Virginica dissecta (cut-leaved Virginia creeper); bignonia capreolata (tendrilled trumpet flower); bignonia grandiflora (Hardy large trumpet flower); decumaria barbara; euonymus radicans (spindle tree); hedera helix (English ivy); clematis paniculata (panicled clematis); lonicera sempervirens (trumpet honeysuckle); periploca græca (milk-vine, silk-vine or climbing dog's-bane); rosa crimson rambler; rosa pink rcamer; rosa wichuraiana (memorial rose).



Plan of Santa Fe Station and Hotel Grounds at Albuquerque, N. M.

The list of the trees and shrubs disposed of in the various groups about the buildings is as follows: Acanthopanax ricinifolia; aralia spinosa (angelica tree, Hercules' club, devil's walking-stick); berberis concinna; berberis dulcis nana (edible-fruited barberry); berberis thunbergii; cæsalpina pulcherrima (Barbadoes pride; flower fence); ceanothus Americana (New Jersey tea plant; mountain sweet; wild snowball); caryopteris mastacanthns (blue spirea); clerodendron fœtidum (glory tree); cornus alba (white-berried dog-wood); elæagnus angustifolia (Bohemian oleaster); hibiscus syriacus (Rose of Sharon); kerria Japonica (Japanese rose); lespedeza sieboldi (bush clover); mahonia aquifolia (holly-leaved barberry); mahonia Japonica (Japanese barberry); punica granatum (pomegranate); ribes aurea (Buffalo currant); rhus glabra laciniata (fern-leaved sumach); robinia hispida (rose acacia); rosa rubiginosa (sweet briar rose); rosa rugosa (Turkestan dwarf rose); spiræa billardii; spiræa bumalda anthony waterer; spiræa prunifolia (plum-leafed spirea); stuartia Virginica; syringa persica (Persian lilac).

Inclosed by the Alvarado, its two east wings and the museum, is a beautiful closed court with a fountain in the center and bits of lawn with tropical foliage plants in the corners. This restful place can be enjoyed from the wide colonnade leading around its three sides and from the walks leading through it. The center of the north lawn is occupied by an electric fountain, where four spacious walks, traversing the lawn, meet.

Keeping alive the trees, shrubs and other ornamental material was a hard proposition, but a harder one was to establish an evergreen lawn in an altitude like this, having a rainfall and humidity much below the requirements of the Kentucky blue grass. The grounds at Las Vegas were planted with sod brought from Lawrence, Kan., and subirrigated by the Richter system. This was only a partial success as the ground is almost impervious to water, and the percolation was too slow for the rapid action of the dry atmosphere. At Albuquerque another system was tried—Herman Blucher's system of flooding—which has worked admirably.

The necessary supply pipes and appliances were laid, the grade finished over them and everything made ready when the grass was sown and the water turned on for a time sufficient to soak the ground about 6 in. deep. In 10 days the lawn was a solid green surface and in a month after sowing it had to be mowed. Besides being a great success this system is important as a labor-saver. The man in charge starts at a certain place to turn on the water to the different plats. By the time he has turned on the last valve he can begin again at the first and turn them all off in the same order, and the work is done. The shrubs and trees being in the same level with the grass receive the benefit of the moisture and everything grows in profusion, making an oasis in the desert.

Apprenticeship.*

The question of instructing apprentices to make good mechanics of them is harder to deal with than in the past. At present there is a desire among the apprentices themselves to take advantage of present-day opportunities to obtain instruction in drawing and other subjects. Many of the older mechanics, however, who have not had similar advantages, do not like to see apprentices become efficient or able to do a man's work along certain lines, which they are able to do in a great many cases, after having been in the service only a short time. It is this influence exerted over the apprentices with which we have to contend. Being young, the apprentices are easily influenced. Some of the older mechanics, who have not enjoyed the privileges of better education and better system of learning a trade, and who belong to organizations which are not interested in progress, have a tendency to influence the apprentices against their own self-interests. The apprentices are led to believe that employers who wish to educate them and make good men of them have some ulterior object in view. The older mechanics are afraid that the coming generation will be won from allegiance to the unions, and will become more loyal to their employers. They therefore endeavor to create in the minds of the apprentices the idea that the highest object in a trade is to get as much money as they possibly can for their services from the commencement, rather than to become first class workmen, and ultimately merit better wages and higher positions.

The first requisite in selecting an apprentice is to know that he is morally, physically and mentally capable of fulfilling the requirements of a mechanic. To ascertain this, an apprentice should be required to make his application for employment direct to the master mechanic or general foreman. He should be between the ages of 15 and 18 years. He should also be required to undergo a medical examination, so as to insure the head of department that he is healthy and likely to be able to follow up the trade after he has completed the term of apprenticeship. This information being satisfactory, he should then pass an examination in the master mechanic's or general foreman's office. This can be conducted by the chief clerk the examination to be as follows:

Eyesight and Reading.—To be able to read extracts from instructions at end of employees' time-table, standing 30 in. from same.

Hearing.—To be able to hear the ticking of an ordinary open-face watch at a distance of 4 ft.

Writing and Spelling.—By writing a letter, from dictation, applying for employment in the shops.

Arithmetic.—To be able to work out correctly similar examples to the following:

Multiply 122,983,672 by 527,001.

Divide 723,643,978 by 365.

In these examples there is sufficient to show whether or not he has a general knowledge of the simple elements of arithmetic. We usually find a boy, to be able to pass this examination, requires to be capable of trying for his entrance examination to a high school.

Apprentices, after having passed a successful examination, should be provided with a book of rules for their guidance. This book should contain an examination for the apprentice for each promotion he takes while serving his apprenticeship, and if he fails in any of these examinations he should be sent back to his old position for another term, and the next apprentice in turn should be promoted ahead of him. When another promotion is necessary, he is sent up for examination, and if he fails a second time, he should be dismissed from the service, as we may conclude that the boy is not sufficiently intelligent to learn a trade, or is too indifferent. During the last year with this system we have had two failures of apprentices in their first examination, but being turned down and other apprentices being promoted ahead of them had the desired effect, and they got down to business. We have not found it necessary to dismiss any apprentices up to the present time.

After passing a successful examination in the master mechanic's or general foreman's office, the apprentice should be sent to the boiler shop, coppersmith shop, or some other shop, as may be required. It will do him no harm, but will be rather to his advantage to remain there from six to 12 months. He will be under the supervision of the foreman, and directly under the gang he is working in, where he is taught to be active and obedient, and will become fairly well posted in the work which is to follow later on. He will be promoted from any of these shops to the machine shop when necessary. When a boy is to learn only one branch of the business—for instance, fitting and erecting—four years is all that is necessary, but if he is to learn the turning and fitting, he should serve five years. Whenever it is practicable, I would recommend the latter training for apprentices. When an apprentice is to go from some other shop to the machine shop, he will undergo an examination by the foreman before he will be accepted. This is the first examination for apprentices from other shops to the machine shop. As the first machine he will be called upon to run will be a drilling machine, the examination will include questions relative to the weight of a standard machinist's hand hammer, the point for holding it and length of standard handle, classes of drills used and how to grind them, speeds for drilling and tapping different-sized holes in different metals, kinds of tools needed for laying off and measuring work at a drilling machine; also a half-size drawing should be made of a crank pin. The apprentice will have six months or a year to learn this. Though he should not be compelled to memorize the speeds for drilling and tapping, he should be encouraged to do so; but a schedule on the machine should contain the necessary information.

After three or four months he will pass to a shaper or planer and should be examined on cutting speeds, kinds of tools used, method of securing work in machine, etc.; also another drawing should be made.

After six or seven months he should undergo a third examination for promotion to a lathe. The list of questions includes methods of centering, information about thread cutting, cutting speeds for various materials, allowances and principles for turning pressure and shrink fits, etc. He should have about 18 months of lathe work, going next to vise work or the erecting shop. For vise work the examination questions include classes of chisels and files, methods of grinding chisels, and methods of doing vise work. Another drawing is required.

If taking vise work, the apprentice should go to the motion bench and remain about three months, going next to the main and side rods for three months, after which he should take a three months' course on driving boxes. After going through these different classes of work he should be sent to the erecting shop, where he should finish the balance of his five years of apprenticeship in the different gangs—for instance, three months in the steam-pipe gang putting up steam and exhaust pipes; three months in the valve gang, facing up valves, putting on steam chests, etc., and three months in slide-bar gang putting up slide bars. After working in these gangs he should be turned into general work in the erecting gangs, where he gets general knowledge. When he has completed his term of apprenticeship, and before getting journeymen's wages, he should undergo a final examination, and explain how to set eccentrics and valves, how to square up an engine, and to lay off shoes and wedges, etc. The great advantage of these examinations is that the boy gets theoretically posted on the different machines he is going to run before he goes to them, and that, with a little instruction from his foreman or man in charge of machines, he is able to start in and do business at once.

The system outlined is in practical use on the Grand Trunk to-day. I have only given a small example of the information found in our apprenticeship rule book, which contains much more than is required by apprentices in every-day shop practice, and which gives good rules for all the different classes of work and tools used. The answers to all of the questions asked in the examinations are given in this book.

As at each examination the apprentice is required to make a drawing, it is necessary for him to be instructed in mechanical drawing, and companies and corporations should furnish the means for him to obtain this education, and it should be furnished entirely free. While it is an advantage to an apprentice to get the instruction, it is also an advantage to the corporations to have their apprentices instructed. There should be two classes, one senior and one junior, and it should be made imperative for all apprentices to attend. A roll book should be kept showing the attendance, and this should be carefully scrutinized by the master mechanic, general foreman or person in charge of the works, and tardy apprentices should be looked after. Those who are particularly attentive and show ability should have a term in the drawing office when possible.

Wages of apprentices is governed largely by conditions and localities, but good fair wages should be paid, so that the best material should be available. I also believe that as soon as an apprentice has completed his term he should be at once recognized and paid according to his ability. If he is capable of earning the best wages in the shops,

*Abstract of a paper presented to a special meeting of the Canadian Railway Club, held in Toronto, Sept. 7, 1903, by Mr. Robert Patterson, Master Mechanic of the Grand Trunk Ry.

he should receive them. If not, he should be paid in proportion. If an apprentice knows that when he is out of his time, if he has ability, he will command the best wages in the shop, it will be an incentive to him to devote all his energies to learning his trade, and make a good man of himself during his term of apprenticeship.

In the past I was averse to legally binding apprentices to fulfil the obligations of their apprenticeship, but my experience has led me to believe that it is now very desirable. An apprentice should be legally bound to fulfil the obligations which he undertook when he entered the service of the corporation. This would be an advantage to the apprentice, as it would tend to keep him satisfied and to prevent him from being tampered with by those who are often anxious for trouble. It would prevent corporations and firms from taking advantage of others who have a good apprenticeship system, and who look after their apprentices properly. I have known cases of apprentices being encouraged to leave their employers before the expiration of their apprenticeship. Some firms, when they are busy and short of men, find that a boy who has served two or three years is capable of doing their special work, and entice him away, regardless of his moral obligation to complete his apprenticeship. This practice cannot be too strongly condemned. It is bad for the employer, and still more injurious to the apprentice, as it is apt to cause dissatisfaction with wages and with employers. Recommendation or service papers should not be given to any apprentice who leaves his employers before his time of agreed service has expired, unless he is compelled to do so for some special reason which is acceptable to them.

A weekly report should also be kept showing progress made by each apprentice, conduct and regularity at work. This can be made out by chargemen, and then put into complete form by the foreman, and sent into the master mechanic's office for reference.

A foreman should find out as early as possible if a boy is not adapted to the work of a mechanic, and dismiss him, so that he can find employment more fitting to his ability. This would entail less work on chargemen and foremen, and make superior mechanics.

The Care of Locomotive Boilers.

In the *Railroad Gazette* of Aug. 28 last was a liberal abstract of a paper by Mr. M. E. Wells on the above subject, which was presented to the Pacific Coast Railway Club. The following extracts have been taken from the discussion which followed the reading of the paper.

Mr. H. Stillman.—Too little time is taken in cooling down and washing boilers. Shortness of power and absolute lack of time in which to furnish power demanded for road service very often and for long periods prevent slow cooling. Trains must be run, and our engines and tools are but accessories. The locomotive boiler suffers more from emergenices than any one factor in our business. The president of a railroad is the only man that could make a rule for washing boilers that could be adhered to. Any one else, from the general manager down, would hear from the head office very soon to know why trains were not being run. It may be that the cost of hurried service is less than interest on first cost of a larger investment for sufficient power. My personal conviction is that we are paying an enormous rate of interest.

Cooling and heating go on relatively during service of a boiler. Faulty regulation of dampers and regulation of draft affect this relative temperature or cooling. Take, for instance, an oil-burning boiler working at full capacity. Approaching a station or summit of a grade, the engineer shuts off steam and the fireman shuts off the oil. A fire-box temperature, under forced draft, of above 2,500 deg. is suddenly reduced to 850 or 1,000 deg. I do not mean that fire-box plates are heated and cooled to the above extremes, but strains are induced.

Bulging and cracking of sheets occurs as often during service as out of service, though we have many cases of cracks occurring in roundhouses. There is much truth in Mr. Wells's statement about the bulging of a piece of No. 8 iron by repeated heating to redness and quenching in water, though more properly such action should be called warping. Bulging of a sheet is the result of metal strained beyond its elastic limit. Its ductility allows it to pull out and the metal elongates between the points of support, which are the staybolts. What is familiarly known as mud-burning is the result of this action; the metal becomes overheated and its elastic limit is reduced in consequence. The warping action of repeated heating and cooling may produce the same appearance, but it would be universal in fire-boxes if it always produced it. Cracking does not always follow bulging. I have seen many cracked sheets that were not bulged and many bulged sheets that were not cracked. Cracking, more than bulging, is a function of the quality of the material.

If water is let out of a boiler too quickly, the sludge, consisting of carbonates, will bake on the hot sheets and form scale. Oxidation is the ultimate but not always the prime cause of corrosion. Chemical reactions cause corrosion when using water containing chlorides, lime or magnesia. These salts are unstable and the chlorine attacks the boiler iron which is unstable and the iron is easily oxidized.

Mr. W. J. Thomas.—Most trouble with boilers is caused by expansion and contraction. Our present method of feeding water to locomotive boilers is bad practice. If a man is climbing a hill with a heavy train, he is going to allow his water to run low, especially when using oil as fuel. At the top of the hill the fireman cuts the fire down to suit the steam pressure, and fills the boiler with cold water, which causes contraction of the lower parts of the boiler. The temperature of the boiler has nothing to do with contraction and expansion. If it is kept at one temperature no damage is done.

Mr. H. L. Stevenson.—Varying temperatures in the fire-boxes have much to do with cracking side-sheets, which may be due, where oil is used as fuel, largely to poor firing. We always taught the men to fire these engines without smoke, which has had a bad result, because the men will put the fire out at times, or reduce the fire to a low temperature, which results in contracting the sheets.

We have had a great deal of trouble keeping boilers clean. We have not locomotives enough to lay the engines up, and not sufficient time to cool the boilers properly. If the boilers are blown off every 8 or 10 miles for a minute, the sediment will be blown out, and, instead of washing the boilers every two or three days, they might possibly run 15 to 30 days.

Mr. G. S. Hale.—On the Chicago & North Western they used surface blow-offs. They had a skimmer arrangement placed above the flue sheet that was supposed to gather up the alkali and foreign matter and lead it off through these surface blow-offs. In the roundhouse was a small boiler, and the water that was used to wash out engine boilers went through an injector which heated it up.

Mr. M. E. Wells.—We have had cases on our road where, in certain boilers, the fire-boxes were ruined in 12 months, and the engines went into the shop for new fire-boxes. We have also identically the same boilers, under practically parallel conditions regarding water and service, that are running yet; they are three or four years old and have the same fire-boxes that were put in when built. I am positive that the fire-boxes were ruined while the engines were in the roundhouse. These other engines of the same make have pulled the same number of tons every month, made about the same mileage, and have done the same work; yet they are three or four years old, and the fire-boxes are as smooth as the day they were put in. They are neither cracked nor corrugated, and will run three or four years more, with proper treatment. The corrugating of fire-boxes is caused by inequality in cooling. I do not mean to say that you can wash a boiler out hot once and crack it; but if the process is continued, it will ultimately corrugate and crack the fire-box sheet, each one of the improper coolings contributing a little to the final result. We have a few engines that have cracked with very little corrugating, because the metal was hard and brittle, and others that have run four or five years without cracking, on account of the softness of the material. And this is the reason soft charcoal iron is desirable for fire-boxes.

You must show your officials that it pays to take care of the boilers. A little over a year ago the boiler failures on our road were 75 per cent. of the total engine failures. We have on our road over 4,000 miles of track and 450 locomotives. In the month of June, this year, we had only 13 delays from leaking flues. I have known the time when one engine had more than 13 in a month.

Water begins to foam when it gets to a degree of saturation equal to about 150 to 200 grains per gallon. You have only to get two boilers of such water through a locomotive to get 150 grains.

In regard to the question of putting feed water in boilers. Our engineer of tests made a test along this line. He took one of the wide fire-box, prairie-type engines, and put four thermometers in the left front corner of the fire-box. He had the thermometer bulbs in oil, then screwed the bulb with the oil cup into the boiler, so that the temperature registered close to the water in the boiler. He had water in the bottom of the glass, had fire in the fire-box, blew steam up to 195 lbs., and shut off the blower. He then read his thermometers and found that the bottom one was a little the hottest. He then worked his injector till it filled the glass full. Then he read his thermometers again, and found that, while the top thermometer had dropped 4 or 5 deg., the bottom one had fallen over 100 deg. The flues in the boiler were 17 ft. long. A reduction of 100 deg. in temperature with 17-ft. flues means a shortening of ⅛ in. Is it any wonder that the bottom flues leak? I have kept a record of engines arriving and the condition of the fuel, and in four days, during which time I kept note of 80 engines, 78 of them arrived dry, and the other two had not to exceed 50 flues leaking. After getting this record, I went into the roundhouse and got the boilermaker's report. His report showed that 1,300 flues leaked between the time they arrived at the pit and the time they were put in the roundhouse. This was not because the engines stood over the pit with blower working, but because they were filled up with water after the fire was out. You can tell from examining the flue-sheet which injector was worked in filling the boiler, because if the right injector is worked, the right bottom flues leak, and vice versa.

Foreign Railroad Notes.

In the month of August the Simplon Tunnel advanced 1,076 ft. This makes a total of nearly 10½ miles, leaving 9,199 ft. to be excavated. A hot spring delayed work at the south end for 10 days. The amount of water issuing then decreased a little.

The estimates for the German Usambara Railroad in East Africa (52 miles long) are that the earnings will not be quite half as great as the expenses, but much is hoped from a great reduction of freight rates; for instance the charge for carrying a mule or a donkey over the road had been $10, and it was reduced to $4.40 for a mule and $1.75 for a donkey. Naturally under the old tariff any intelligent donkey would walk 50 miles rather than pay 20 cents a mile to be carried.

The 2 ft. gage railroad which the Germans have built, mostly through a barren country, from Swakopemund to Windhook, in Southwest Africa, naturally has not been very profitable; and it has been decided to double the passenger rates and increase freight rates 25 per cent., making the latter $2.16 per 100 lbs. for the length of the road. Ox-teams, it is said, will carry for that, but they are slower. This reminds one of the early days of the Denver & Leadville Railroad.

At a convention of representatives of street railroads in Berlin last August, a committee reported that models and drawings of 454 different appliances for preventing accidents to persons on the track had been submitted, of which the committee thought that seven might be worth trying. The manager of the chief Berlin lines and the representative of Siemens & Halske, who ought to have the most experience in such matters, declared that there was nothing new in any of the seven designs submitted, and that the best protection consists in a good brake, well trained motormen, and the suppression of all projecting parts on the underside of the cars.

TECHNICAL.

Manufacturing and Business.

The Northern Iron Company of Jersey City has been incorporated in New Jersey, with a capital of $200,000, by L. B. Dailey, B. B. Lewis and Joseph M. Mitchell.

The American Locomotive Co. has closed its Chicago office in the Fisher Building. The entire business of the company will be conducted from their New York offices.

The Clark & Norton Mfg. Company, Wellsville, N. Y., has been incorporated in New York, with a capital of $250,000, to make engines and machinery, by C. E. Clark, of Belmont, N. Y.; W. H. Norton and H. A. Higbie.

A contract, it is reported, has been awarded by the Sweet's Steel Company for the building of the rolling mill and open hearth buildings of its new plant at Williamsport, Pa., to the Fort Pitt Bridge Company of Pittsburg.

The Keystone Engineering & Construction Co. has been incorporated in New Jersey, with a capital stock of $100,000, to do a general construction and engineering business, by C. W. Conner and W. T. Forsythe, of Philadelphia, Pa., and E. P. Strang, of Camden, N. J.

The Safety Third Rail Company of New York City has been incorporated in New York, with a capital of $500,000, for the purpose of equipping railroads with safety third rail appliances. Lauren Ingels and John G. Miller, of New York City, and Henry S. White, of Brooklyn, are incorporators.

The Mexican Car & Foundry Company, of which Isaac M. Hutchinson, of Mexico City, is President, will spend about $75,000 in buying necessary machinery for its proposed car building shops to be located in Mexico City. The company expects to turn out 20 cars per day. Contracts will be let in a few weeks.

At a meeting of the Directors of the Union Switch & Signal Company held in Pittsburg Monday, September 28, the regular dividend rate on the stock of the company was made 10 per cent. yearly on the preferred and 8 per cent. on the common; these having been, respectively, 9 per cent. and 6 per cent. A quarterly dividend was declared at these rates.

The New York sales offices of the Westinghouse Electric & Mfg. Co. have been removed from the Equitable Building, 120 Broadway, to the new Hanover Bank Building, corner of Nassau and Pine streets. The new offices occupy the entire 17th floot of the building. The executive, financial and stock transfer offices will remain on the fourth floor of the Equitable Building.

The Sterlingworth Railway Supply Co., Philadelphia, has completed an order of 1,000 Sterlingworth, 80,000-lb. trucks for the Southern Railway. The Chesapeake & Ohio has specified Sterlingworth trucks, bolster type, on 80 locomotives recently ordered from the Baldwin and American Locomotive Companies. These trucks are of special design for particularly severe service, and are of 100,000 lbs. capacity.

In our issue of July 24, last, the details of the oil burning devices on Southern Pacific engines were described. The connections between engine and tender for the steam and oil pipes are Martin metallic conduits. About 250 locomotives have been equipped with 1½ in. conduits for oil and ½ in. conduits for steam. They are giving excellent satisfaction. The Martin metallic conduits are sold by the Holland Co., New York and Chicago.

The H. W. Johns-Manville Co., New York, recently received an order from the War Department for 14,020 rolls of roofing for the army buildings in the Philippines. This is said to be the largest order ever given for roofing. One part of the order, 11,120 rolls, was delivered in 30 days, and the rest, 2,900 rolls, in 10 days. The Pittsburg office of this company, on account of increased business, has secured the adjoining property and now occupies the entire building at 218-220 First avenue.

The Westinghouse Machine Co., Pittsburg, has received the order for three steam turbines of 7,400 electrical horse-power each, to form the initial instalment of machinery in the Long Island power house of the Pennsylvania, now building, and which will supply power for the Hudson and East River tunnels and such parts of the Long Island R. R. as may be electrified. These turbines will be of the Westinghouse, horizontal, short-barreled type, direct-connected to 5,500 k.w., three-phase alternators operating in parallel.

The Carborundum Co. is making further enlargements to its plant at Niagara Falls. Four acres of land adjoining the present works has been bought and on this will be built a two-story mixing and furnace building, 146 ft. x 134 ft. Provisions have been made for extensions to this building in two directions in the future. A contract has been made for an additional 2,000 e.h.p., giving in all 5,000 e.h.p. When the new building and furnaces are completed the company will have a capacity of 10 million pounds of carborundum per year.

The Reade Machinery Company, Cleveland, Ohio, has built a shop at Collinwood, Ohio, devoted exclusively to repairing locomotives. This shop is on a five acre lot adjoining the Lake Shore & Michigan Southern Railway shops. A long track has been laid for testing locomotives. The shop has two pits and the company is prepared to do all classes of locomotive work, including turning tires, reboring cylinders, putting new tubes in boilers and overhauling machinery and piping. It also repairs steam shovels and other contractors' machinery, and buys and sells second-hand railroad contractors' equipment.

The Iron Clad Paint Company, Cleveland, Ohio, reports that its business has about doubled in the past year. The daily capacity of the works is about 2,000 gallons. The company makes nine varieties of "Iron Clad" paint and three grades of white lead together with floor paints and asphaltum paint. The products are known as hard specular iron ore paints and are made from Lake Superior ore and graphite. The "Iron Clad" paint has been on the market for 33 years and is claimed to be water proof, highly refractory, and impervious to the action of acids, alkalis, etc., which makes it especially desirable for outside and inside work on metallic surfaces. It is guaranteed for five years. The paint is used by 21 railroads. The officers of the company are: F. H. Chamberlin, President; R. H. Coleman, Manager; J. D. Smith, Secretary and Treasurer. The company has branches in Chicago, New York, Cincinnati and Quebec, Canada.

The Safety Car Heating & Lighting Company has received from the Messrs. Pintsch, of Berlin, Germany, a statement showing the number of cars and locomotives in the different countries which are equipped with the Pintsch system of lighting. The statement also gives the number of Pintsch gas works now in operation and the number of Pintsch buoys and beacons in service. The total number of cars having Pintsch light is 119,031 for 23 countries, the increase for the year being 6,840. Germany has 42,850, the United States 20,550, England 19,200, India 10,200, France 6,758, Austria 4,758, Holland 3,487, and Russia 3,360. The total number of locomotives is 5,431 for seven countries, the increase over the previous year being 434. Of this number, Germany has 5,200. There are 347 Pintsch gas works in operation in 22 countries, England having 87, Germany 71, and the United States 63. The total number of buoys and beacons is 1,380: increase, 169.

Iron and Steel.

The Damascus Steel Company, maker of steel tools, will spend about $15,000 in enlarging and equipping its furnace at New Brighton, Pa., for making crucible steel castings.

The Dover Forge & Iron Company, Canal Dover, Ohio, is rapidly completing its new works for making charcoal iron slabs, blooms and billets, puddled iron sheet bars and muck bars. The company is going to reorganize under the laws of Ohio.

Work has been resumed at the Clairton plant of the Crucible Steel Company, a subsidiary company of the United States Steel Corporation, after a shut-down of three weeks for repairs on the furnaces and mills. All the open hearth furnaces have also resumed.

The Delaware River Steel Company, Chester, Pa., has been organized in Delaware, with a capital of $500,000, and is building large shops on land adjoining the Vulcan Brass Works. The officers are Major E. H. Goodman, President; J. Parker Crittenden, Treasurer, and Edward J. Altemus, Secretary.

The Buffalo Steel Company, Tonawanda, N. Y., after a shut down of a month and a half for repairs and for putting in new continuous furnaces and automatic cooling beds, has resumed work. The company makes Bessemer bar steel, special shapes for agricultural implements and light rails. The output will be greatly increased.

M. C. B. Letter Ballot.

The secretary of the M. C. B. Association has announced the result of the letter ballot on changes in standards and recommended practice proposed at the last convention. All of the 58 changes voted on have been adopted.

Acetylene Car Lighting on the Chicago Great Western.

For the past four years the Chicago Great Western has been experimenting with the acetylene gas lighting system of the Adams & Westlake Company, Chicago, on 25 or 30 passenger cars in regular service. This system has proved satisfactory and as a result the road has specified the "Adlake" system on the 36 cars recently ordered from the Pullman Company.

Stake Pockets.

The Committee on Stake Pockets of the M. C. B. Association has sent out a circular of inquiry to assist in making recommendations to the next convention on standard stake pockets and their location on a part of or on all flat and gondola cars. Answers are requested to 10 questions and replies should be sent to the chairman, Mr. John S. Chambers, S. M. P., Atlantic Coast Line, Wilmington, N. C.

THE SCRAP HEAP.

Wireless Telegraphy in the Navy.

The Navy Department will buy 25 more sets of wireless telegraph instruments, in addition to the 20 sets bought not long ago as noted at the time. The 20 sets are on the principal vessels of the North Atlantic fleet and on shore stations, and the new sets will be put in at Key West, Pensacola, Tortugas, Culebra and Porto Rico, and on other vessels of the fleet.

Fires.

The roundhouse and machine shops of the Pennsylvania, at Lawrence Junction, Pa., were burned down Sept. 20, loss about $30,000.

The conveyor of the Southern Pacific elevator, 1,500 ft. long, at Galveston, Texas, and part of a wharf, was destroyed by fire on the 21st. Loss about $70,000.

The power house of the Brooklyn Rapid Transit Company at 52d street, South Brooklyn, N. Y., was damaged to the extent of $50,000 by a fire on the 26th.

To Study American Street Railroads.

The Royal Commission on London City Traffic appointed to study street railroad systems in America with a view to bettering the conditions in Great Britain and especially in London, arrived in New York September 29. Sir David Barbour, K. C. M. G., is Chairman, and Lynden L. Macassey is Secretary. The other members of the Commission are George S. Gibb, General Manager of the North Eastern; Lord Ribblesdale; Sir John Dickson-Poynder, M. P., and Sir George Bartley, M. P. The Commissioners intend to investigate every branch of American street railroading. Three weeks will be spent in New York and Boston.

Train Robbers.

On the night of September 23, the eastbound passenger train of the Oregon Railroad & Transportation Company was stopped by four masked men near Corbett, Ore., and the door of the express car was blown open with dynamite. The robbers determined to use the engineman in helping them overcome the express messenger, but Messenger Kerner shot and killed one of the robbers and wounded another. The robbers then fled. The engineman was injured by the same bullet which killed the first robber. Train No. 41 of the Burlington & Missouri River was stopped by robbers near St. Joseph, Mo., on the night of the 22d, and the express car was wrecked by the use of dynamite. Reports are conflicting as to whether the robbers secured much money.

Blackmail by a New Process.

A press despatch from Helena says that because the Northern Pacific refused to comply with the demands of a gang of dynamiters to deposit a sum of money at a place between Garrison and Missoula, four attempts have been made within the last two weeks to carry out the threat to "blow the property of the company in Montana off the map." A notice was sent to officers of the company demanding $25,000 and that $50,000 be given to the engineer of a light engine to be delivered by him at a designated place west of Garrison, on a certain date and at a given signal, to the bandits. A light engine was sent out as directed, but a second one followed with a dozen or more armed men, but none of the conspirators was to be found. The railroad has since been warned that because of this "trifling" the original threat would now be carried out; and four attempts have been made to wreck trains by the use of dynamite.

Disaster to the Fast Mail at Danville, Va.

On Sunday afternoon, September 27, fast mail train No. 97 of the Southern Railway was derailed near a trestle bridge one-half mile north of Danville, Va., while running at full speed, and the whole train, consisting of engine, mail and express cars fell 75 ft. to the rocky bottom of the stream below. Of the 16 trainmen, mail clerks and express messengers on the train, nine were killed and the other seven were injured, some of them fatally. The wreck took fire, but the flames were extinguished by the Danville fire department. The reports give no light on the cause of the derailment. An officer of the road says: "The train consisted of two postal cars, one express car, and one baggage car for mails. The trestle is very little damaged, as the train jumped the track about 40 ft. north of the trestle on sound track, in good line and surface and proper gage. Eye-witnesses report that the train was approaching the trestle at a rate of speed of 30 to 35 miles an hour. The cause of the accident is being investigated."

A Locomotive Runner of 1832.

The "*Royal Blue*" of the Baltimore & Ohio for September contains a full-page portrait of Mr. Christian Smith, who, at the age of 91, is still living on his farm in Maryland near Harper's Ferry, and who was a main-line teamster on the Baltimore & Ohio in 1832, when the cars were drawn by horses, and the locomotive was yet to appear. Mr. Smith retired from railroad work in 1873 and has lived a quiet life ever since. He is hale and hearty, talks with straightforwardness and "never hesitates or becomes rambling in a narrative." His first work on the Baltimore & Ohio was as a driver between Frederick and Plane No. 4, 15 miles. His team consisted of three horses harnessed tandem. As heavier freight cars were put on his motive power was increased until he drove a team of three pairs. Mr. Smith was soon promoted to be a brakeman on Plane No. 1, and when the locomotives came was made fireman. He fired the "Andrew Jackson," one of the 12½-ton Grasshoppers, and later was made a runner, taking the "John Quincy Adams." Mr. Smith was at one time supervisor of engines on the road and also station agent.

Paternalism in Railroading—$193 a Year.

The Austrian Railroad Ministry is investigating the condition of its employees. It began with the track watchmen, and to collect information it sent out a general circular of inquiry which was filled out by no less than 7,283 of the watchmen on the State Railroads, while a more minute inquiry was returned by 447.

The track watchmen on the State Railroads receive for the first five years after definite appointment 576 crowns per year as wages, for the next five years 648 crowns, and after ten years service 720 crowns ($116.52, $131.09, and $145.65 respectively). In most cases, however, these wages are increased by certain allowances and premiums, and the average actual pay is $142.23. From this are deducted certain contributions to hospital funds, etc., leaving in their own hands an average of $134.73. Besides this those who are not given the use of dwellings belonging to the railroads (and these are about one-fourth of the whole number) have an allowance for house-rent. Most of them are supplied with coal at its cost to the railroad; and they are given the free use of small parcels of land belonging to the railroads (chiefly on its right of way), generally used for gardens, and they sometimes rent more; and they often keep cows and poultry. No less than 96 per cent. of the watchmen are married.

The 447 replies of the more minute character show that the value of the total income of each family from the railroad, including rents, uniform clothing, fuel in excess of market price, etc., was $170.75. To this about $18 was added by the earnings of wife and children and a trifle from other sources, giving an average of about $193 for the support of the family. The aggregate property of these 447 families was less than $28,000, and they owed (chiefly for this property) about $16,500. Their aggregate cash capital was less than $1,000—$2.24 per family. Nevertheless, it is said that their circumstances are better than those of the average Austrian laborer, and their positions are permanent.

The report also gives information as to the dwellings occupied by the watchmen's families in considerable detail. It is the first of a series of sociological investigations into the condition of the several classes of Austrian railroad employees. The next will relate to the workmen in the shops.

Long Trains on the Reading.

During the month of August a number of experimental trains were run on the Philadelphia & Reading to determine: First, the relative efficiency of two engines, class I-7 cd, and class I-5 c; and, second, the maximum tonnage for usual trains. The first experimental train was run on August 5, with 3,640 tons, and was hauled by engine 953, and the trials were continued, the tonnage being increased, until on August 23 a train of 5,372 tons was hauled by engine 1,095. This last-mentioned train consisted of 79 100,000-lb. capacity cars, loaded with bituminous coal, and was hauled from Reading to West Manayunk, 51.1 miles, over a river grade, with no adverse grade worth mentioning. The road is double track, with a limited number of passing sidings. Between the points named an extraordinary amount of traffic, probably heavier than on any similar railroad, is moved, and, in addition, passenger trains are frequent and fast. The trains were run without making any special despatching arrangements. Engine 953 is a wide fire-box consolidation, with 76 sq. ft. of grate area to burn steam-size anthracite coal. Engine 1,095 is also a consolidation, but burns bituminous coal on a grate of 47½ sq. ft.

Below are certain details of three trains hauled by each engine between August 13 and 23. While the six trains were hauled through all right, they were too heavy for every day work; but they were valuable as demonstrating that the relative efficiency of the engines was the same. Also it was settled that with all the cars of high capacity, and a sufficient number of lay-off or running freight tracks, the present maximum freight train can be greatly increased.

	Engine 953.	Engine 1095.
Weight of engine and tender loaded, lbs.	226,900	282,700
Weight of engine, lbs.	154,500	166,300
Weight on drivers, lbs.	138,500	146,950
Weight on trucks, lbs.	16,000	19,350
Weight of tender loaded, lbs.	72,400	116,400
Cylinders, in.	22 x 28	22 x 28
Driving wheels, diameter, in.	50½	56
Heating surface, sq. ft.	1,817	2,126
Steam pressure, lbs.	175	200

			Reading to Abrams, 39.7 miles.		Reading to W. Manayunk, 51.1 miles.		Reading to Woodland, 47.1 miles.	
Eng.	Cars.	Tons.	Elap. time. H.M.	Run. time. H.M.	Elap. time. H.M.	Run. time. H.M.	Elap. time. H.M.	Run. time. H.M.
1095	70	4,821	3:46	3:22	...	...	...	...
1095	75	5,021	4:54	3:00	...	...	...	...
1095	79	5,372	...	...	6:04	3:33	...	...
953	73	4,926	...	...	6:33	4:08	...	...
953	75	5,166	...	...	...	...	4:05	2:53
953	77	5,211	...	...	...	...	7:18	4:06

PERSONAL.

—Mr. James Gordon, Assistant Trainmaster of the Pennsylvania Railroad at Trenton, N. J., began working for the company 50 years ago, and has been in its employ ever since, except for the time he served as a soldier in the war of the rebellion. He is 64 years old.

—Mr. W. W. Flack, Superintendent of the Columbia River & Northern at Lyle, Wash., died recently. Mr. Flack was about 45 years old and was a native of Quincy, Ill. He had been in railroad service many years, beginning on the Wabash. He was for a time on the Chicago, Rock Island & Pacific.

—Mr. Daniel Cooper, of Suffern, N. Y., has just retired from his position as passenger conductor on the Erie Railroad after 53 years' service for the road. Mr. Cooper has been in the train service throughout this long period, except two periods of four years each, when he was station agent. Latterly Mr. Cooper's run has been between Jersey City and Binghamton, 214 miles.

—Mr. I. L. Hibbard, the new Superintendent of the Southern California at San Bernardino, Cal., was born at Woodhull, N. Y., in 1857. His first railroad service was on the Erie Railroad in 1876, and in 1880 he was made a clerk in the New England office of that road in Boston. From 1881 to 1883 he was on the Indianapolis & St. Louis and in the latter year he was in the General Superintendent's office of the Wabash. For about four years he was Trainmaster for this road at Forest, Ill., and in 1897 was appointed Superintendent of the Albuquerque Division of the Atchison, Topeka & Santa Fe, where he has been ever since. Mr. Hibbard assumed his duties on the Southern California on Thursday of this week.

—Mr. Robert S. Parsons, who has succeeded Mr. Davis, as Engineer of Maintenance of Way of the Erie Railroad, was born in 1873. Mr. Parsons graduated from Rutgers College. His first railroad experience was as a transitman on the New York Division of the Erie in 1895. The next year he was made Assistant Engineer, and in 1897 Assistant Engineer of the Buffalo Division. Then for about four years Mr. Parsons was Assistant Engineer on the New York, Susquehanna & Western (Erie), and in 1902 was promoted to be Division Engineer. He assumed his new duties on Sept. 1, last. His office is at Jersey City.

—Mr. John Manning Hall, who on Thursday last retired from the Presidency of the New York, New Haven & Hartford Railroad, was born in Willimantic, Conn., in 1841. He was educated at Williston Seminary, Easthampton, Mass., and at Yale, graduating in the class of '66. In 1868 Mr. Hall was admitted to the Bar in New York city and to the Connecticut Bar in 1869. He practiced law in Willimantic until elected Judge of the Superior Court of Connecticut in 1889. He was a member of the Connecticut Legislature in 1870, 1871 and 1872, and in 1881, 1882 and 1889; holding the Chairmanships of important committees. In 1882 he was Speaker of the Assembly and in 1883 President pro-tem of the Senate. In that year he was appointed to the Bench and he continued in that office until 1893, when he was made Vice-President of the railroad company. He was promoted to the Presidency on the retirement of President Clark in 1899. In his presidency, Judge Hall has been the lawyer, judicial and conservative, rather than the operating man. He may be said to represent a type more frequently found at the head of an English railroad company than of an American, standing less for aggressiveness and adaptability than for a high degree of personal dignity and integrity, and representing the stockholders not on account of his skill acquired in practical railroading, but rather through his reputation as a safe man and an honored citizen.

—Mr. S. W. Knapp, the new Superintendent and Traffic Manager of the Detroit & Toledo Shore Line, began his railroad service on the old North Missouri road, now a part of the Wabash, in 1864. Then for a time he was on the St. Louis, Iron Mountain & Southern, and during 1865 and 1866 he was on the Mobile & Ohio. Mr. Knapp later went west and for 27 years was in the transportation department of the Central and the Southern Pacific. For a number of years he has been in other business, but on the first of September this year returned to railroading, becoming Superintendent and Traffic Manager of the Detroit & Toledo Shore Line.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—J. A. Carroll has been appointed Road Foreman of Engines of the Albuquerque Division.

Baltimore & Ohio.—M. C. Byers, hitherto Assistant Engineer of Maintenance of Way, has been appointed Engineer of Maintenance of Way, with headquarters at Baltimore, succeeding H. B. Voorhees, transferred. J. R. Leighty, Engineer of Maintenance of Way at Parkersburg, W. Va., has been transferred to Cumberland, Md., and is succeeded at Parkersburg by R. R. Lukens, formerly Engineer of Maintenance of Way at Cumberland.

Central of New Jersey.—See Philadelphia & Reading below.

Chicago, Burlington & Quincy.—John H. Duggan, Division Superintendent, with headquarters at Burlington, Iowa, has resigned.

Chicago, Milwaukee & St. Paul.—J. A. Stewart has been elected a Director, succeeding August Belmont.

Chicago, Rock Island & Pacific.—T. Rooke has been appointed Assistant Superintendent of Motive Power, with headquarters at Topeka, Kan.

Colorado & Southern.—J. D. Stack has been appointed Assistant Superintendent, with headquarters at Trinidad, Colo.

Elliott & Mount Holly.—J. T. Burkett, Secretary and Treasurer, with headquarters at Elliott, Ark., has resigned.

Erie.—At a meeting held Sept. 30, E. H. Harriman was elected a Director, succeeding the late Abram S. Hewitt.

Missouri, Kansas & Texas.—E. M. Alvord, hitherto General Superintendent of the Missouri, Kansas & Texas of Texas, has been appointed General Superintendent of the M., K. & T., with headquarters at St. Louis, Mo., succeeding the late E. M. Collins. T. S. McDowell, hitherto Superintendent at Parsons, has been appointed to succeed Mr. Alvord as General Superintendent at Dallas, Texas, and Mr. McDowell in turn is succeeded by J. W. Walton, hitherto Superintendent at Denison, Texas. R. J. Sullivan, hitherto Trainmaster at Denison, has been appointed to succeed Mr. Walton.

Northern Pacific.—J. H. Sally has been appointed Master Mechanic, with headquarters at Livingston, Mont., succeeding W. S. Clarkson, assigned to other duties.

Norfolk & Western.—L. E. Johnson, Vice-President and General Manager, has been elected President in place of H. J. Kimball, deceased.

North Shore.—Owing to ill health B. H. Fisher has resigned as Superintendent and has been appointed Chief Engineer, succeeding John Gray, resigned. E. L. Braswell has been appointed Superintendent, succeeding Mr. Fisher, and E. H. Shoemaker has been appointed Assistant Superintendent, succeeding Mr. Braswell.

Philadelphia & Reading.—R. H. Ross has been appointed Assistant Purchasing Agent, with headquarters at Philadelphia, Pa., of this company and the Central of New Jersey, succeeding G. DeWitt Smith, resigned.

Pullman Company.—The headquarters of A. J. Grant, District Superintendent, have been transferred from Cleveland, Ohio, to Chicago, Ill. W. H. Waite has been appointed to succeed Mr. Grant at Cleveland.

St. Louis & San Francisco.—D. G. Reid, W. H. Moore, W. B. Leeds, J. H. Moore and F. L. Hine have been elected Directors, succeeding R. C. Kerens, J. S. Ford, E. C. Henderson, C. W. Willard and H. H. Porter.

San Diego, Pacific Beach & La Jolla.—E. A. Hornbeck, Superintendent of the National City & Otay, and General Manager of the San Diego, Cuyamaca & Eastern, has been appointed General Manager of the S. D., P. B. & L. J., also, with headquarters at San Diego, Cal. John Hetzel, Superintendent, having resigned, that position has been abolished.

Trinity & Brazos Valley.—J. E. W. Fields has been appointed General Freight and Passenger Agent, with headquarters at Hillsboro, Texas.

West Virginia Central & Pittsburg.—H. M. Burgan has been appointed Purchasing Agent, with headquarters at Baltimore, succeeding F. F. Chadwick, assigned to other duties, effective Oct. 1.

LOCOMOTIVE BUILDING.

The Morgantown & Kingwood is having one locomotive built at the Baldwin Works.

The Paulista R. R. of Brazil is having three locomotives built at the Baldwin Works.

The De Queen & Eastern is having one locomotive built at the Pittsburg Works of the American Locomotive Company.

The Buffalo, Rochester & Pittsburg is having two locomotives built at the Schenectady Works of the American Locomotive Company.

The Mexican Central has ordered 68 simple consolidation (2-8-0), 14 simple mogul (2-6-0), and seven simple six-wheel switching (0-6-0) locomotives from the American Locomotive Co. The consolidation locomotives will weigh 187,000 lbs., with 165,000 lbs. on the drivers; cylinders, 21 in. x 26 in.; diameter of drivers, 55 in.; straight top radial stayed wide fire-box boilers, with a working steam pressure of 200 lbs.; heating surface, 2,712 sq. ft.; 350 lap welded charcoal iron tubes, 2 in. in diameter and 14 ft. long; grate area, 44 sq. ft.; tank capacity, 6,000 gal.; coal capacity, 12 tons. The mogul locomotives will weigh 154,000 lbs., with 132,000 lbs. on the drivers; cylinders, 20 x 26 in.; diameter of drivers, 63 in.; straight top radial stayed wide fire-box boilers, with a working steam pressure of 200 lbs.; heating surface, 2,323 sq. ft.; 320 lap welded charcoal iron tubes, 2 in. in diameter and 13 ft. long; fire-box, 96 in. long and 66 in. wide; grate area, 44 sq. ft.; tank capacity, 6,000 gal. of water and 12 tons of coal. The switching locomotives will weigh 126,000 lbs.; cylinders, 19 in. x 24 in.; diameter of drivers, 50 in.; Belpaire boilers, with a working steam pressure of 200 lbs.; 272 lap welded charcoal iron tubes, 2 in. in diameter and 11 ft. $11^{7}/_{16}$ in. long; fire-box, $9^{13}/_{16}$ in. long and 39½ in. wide; tank capacity, 3,900 gal. of water and six tons of coal. The special equipment for all includes: Westinghouse air-brakes, Keasbey & Mattison boiler lagging for consolidation and mogul locomotives, H. W. Johns-Manville "fire-felt" boiler lagging for switching locomotives, National-Hollow brake-beams, Tower couplers, Wilson headlights for consolidation and mogul locomotives, Friedman injectors, Wincheck piston and valve rod packings for consolidation and mogul locomotives, Mexican Central piston and valve rod packings for switching locomotives, Crosby safety valves, Leach sanding devices, Michigan sight-feed lubricators and Crosby steam gages. Other specialties are: Westinghouse friction draft gear, Chatalier water brakes, and Johnstone's blow-off cocks.

CAR BUILDING.

The Canada Atlantic is building 25 stock cars at its own shops.

The American Car & Foundry Co. has miscellaneous orders for 17 cars.

The Lake Carrier Oil Co., Buffalo, is having 10 freights built at McKees Rocks.

The Mexican Great Eastern is reported to be in the market for new equipment.

The Indianapolis Southern is reported to be in the market for passenger cars.

The Atchison, Topeka & Santa Fe has ordered 10 express cars from the Pullman Co.

The Bessemer & Lake Erie has ordered two coaches from the American Car & Foundry Co.

The Bangor & Aroostook has ordered five flat cars from the American Car & Foundry Company.

The Los Angeles, San Pedro & Salt Lake is reported to be in the market for a few passenger cars.

The Erie is having 100 freights built at the West Detroit Works of the American Car & Foundry Co.

The Detroit Southern is having 500 freight cars rebuilt at the Detroit Works of the American Car & Foundry Company. This is not a new order as reported in our issue of Sept. 25.

The Western Australia is in the market for six first class and 12 second class passenger cars. Bids will be received until Nov. 2 by the General Agent for the Western Australia at 15 Victoria street, S. W., London, Eng.

The New York, New Haven & Hartford has ordered 100 copper sheathed passenger coaches from the Wason Manufacturing Co. These cars are to be the same as the 51 which were ordered earlier in the season from the same company, date of delivery to commence in April, 1904.

The Illinois Telephone Construction Company, Chicago, is asking bids on 1,000 steel gondolas with removable sides. These cars will be 9 ft. long, 4 ft. wide, 3 ft. high, with a 2-ft. gage. The order includes four-wheel and eight-wheel cars. The company is also in the market for refrigerator cars and electric locomotives.

The Queen & Crescent is receiving bids on 1,750 freight cars as follows: Two hundred 80,000-lb. hopper bottom coal cars; 100 80,000-lb. drop bottom coal cars: 100 60,000-lb. coke cars for the Alabama Great Southern; 500 box, 500 hopper bottom coal cars, 200 drop bottom coal cars, 100 coke cars and 50 stock cars, all of 60,000 lbs. capacity, for the Cincinnati, New Orleans & Texas Pacific. Specifications have not yet been decided upon.

Crerar, Clinch & Co., Chicago, have ordered 50 coal cars of 80,000 lbs. capacity from the Pullman Co., instead of 58 coal cars of 100,000 lbs. capacity as reported in our issue of September 25. The cars will be 36 ft. long, 9 ft. 4 in. wide, and 3 ft. 6½ in. high, and built of wood. The special equipment includes: American Steel Foundries' bolsters, Simplex brake-beams, Westinghouse air-brakes, Hewitt brasses, Tower couplers, Miner draft rigging, Illinois Central standard cast iron journal boxes, pressed steel lids, Pittsburg Spring & Steel Co.'s springs and arch bar trucks.

The Canadian Pacific is building 25 first class coaches at its shops. The cars will weigh 110,000 lbs., and measure 72 ft. long, 9 ft. 10½ in. wide, over frames; and 14 ft. 8½ in. high from rail. The special equipment includes: National-Hollow brake-beams, Westinghouse air-brakes, Tower couplers, Blount (Yale & Towne) door fastenings, Miner draft rigging, cast iron journal boxes, Canadian Pacific standard journal box lids, acetylene gas light, Sherwin-Williams paint, Standard Coupler Co.'s platforms, Canadian Pacific standard six-wheel trucks and Pullman wide vestibules.

The Delaware, Lackawanna & Western, as reported in our issue of Sept. 25, has ordered 20 open platform passenger coaches from the Wason Mfg. Co. The cars will be 52 ft. long over end sills, 9 ft. 8 in. wide over side sills and 14 ft. 2⅜ in. high over all. Special equipment includes Westinghouse brakes, Magnus Metal Co.'s brasses, steel axles, Streeter steel back brake-shoes, Gould couplers, Forsyth curtain fixtures, Pantasote curtain materials, Symington journal boxes and journal box lids, Pintsch gas, Standard steel platforms, four-wheel passenger trucks, Symington dust guards and Taylor steel tired wheels.

The Denver & Rio Grande, as reported in our issue of July 17, has ordered 600 narrow gage coal cars, 750 narrow gage box cars and 350 narrow gage stock cars from the American Car & Foundry Company. All these cars will have a capacity of 50,000 lbs. The coal cars will be 31 ft. 1 in. long, 6 ft. 11 in. wide, and 3 ft. 4 in. high, inside measurement, with wooden frames and underframes. The box cars will be 29 ft. 5 in. long, 7 ft. wide, and 6 ft. 2½ in. high, inside measurement. The stock cars will be 29 ft. 4 in. long, 7 ft. 3 in. wide and 6 ft. 1¾ in. high, inside measurement. Special equipment for all includes Westinghouse brakes, American steel bolsters, D. & R. G. standard brake-beams and brake-shoes, Magnus Metal Co.'s brasses, Tower couplers, McCord malleable iron journal boxes and journal box lids, Railway Steel-Spring Co.'s springs, American steel trucks, pocket draft rigging and 26-in. cast iron wheels.

The Mexican Central, as reported in our issue of September 11, has ordered 790 box cars of 60,000 lbs. capacity; 150 stock cars of 60,000 lbs. capacity; 100 coal cars of 80,000 lbs. capacity, and 100 flat cars of 80,000 lbs. capacity from the Pullman Co. The box cars will be 36 ft. 6¾ in. long, over end sills; 9 ft. 1 in. wide,

over side sills; and 13 ft. 3 in. high to top of running board. The stock cars will be 34 ft. long, over end sills; 8 ft. 9 in. wide, over side sills; and 12 ft. 7¾ in. high to top of running board. The coal cars will be 34 ft. long, over end sills; 8 ft. 10 in. wide, over side sills; and 8 ft. 6¼ in. high to top of sides. The flat cars will be 34 ft. long, over end sills; 8 ft. 10 in. wide, over side sills; and 4 ft. 2½ in. high to top of floor. The special equipment for all includes: National-Hollow brake-beams, Westinghouse air-brakes, Tower couplers, Wagner doors for box cars, Westinghouse friction draft rigging, Soule dust guards, McCord journal boxes and lids, Sherwin-Williams' paint, Mexican Central galvanized iron roofs for box and stock cars, and Mexican Central standard trucks.

The Chicago Great Western, as reported in our issue of September 25, has ordered 36 cars for passenger service; 11 first class coaches, seven café observation, five milk, four chair, four buffet, three baggage and two mail cars from the Pullman Co., for October and November, 1903, and February and March, 1904, delivery. The coaches will be 60 ft. long, over sills; 10 ft. ¼ in. wide, and 14 ft. 6¼ in. high, over all. The observation cars will be 70 ft. long, over sills; 10 ft. ¼ in. wide and 14 ft. 2⅞ in. high, over all. The milk cars will be 50 ft. long. The chair cars will be 65 ft. long, over sills; 10 ft. ¼ in. wide and 14 ft. 6¼ in. high, over all. The buffet cars will be 63 ft. long, over sills, and 9 ft. 8 in. wide, over all. The baggage cars will be 60 ft. long, over sills; 10 ft. wide and 14 ft. 5⅝ in. high, over all. The mail cars will be 50 ft. 7½ in. long, 10 ft. wide, over sills, and 6 ft. 5½ in. high from top of sill to under plate. The special equipment for all will include: Sterlingworth brake-beams for coaches, Kewanee brake-beams for observation, milk, buffet, baggage and mail cars; National-Hollow brake-beams for chair cars; Westinghouse air-brakes; Chicago couplers; Forsyth curtain fixtures for coaches, observation, buffet and chair cars; Pantasote curtain material for coaches, observation, buffet and chair cars; Pullman standard door fastenings for coaches, observation and chair cars; Symington dust guards; Consolidated steam heating system; Fletcher steel journal box lids; Consolidated Railway Electric Lighting & Equipment Co.'s light for buffet and chair cars; Miller platforms for mail cars; Pullman standard roofs for observation cars; Pullman standard trucks and vestibules for coaches, observation, buffet and chair cars; and Standard Steel Works' wheels for all except milk cars.

BRIDGE BUILDING.

Alma, Kan.—Bids are wanted Oct. 5 by the County Clerk of Wabaunsee County for the building of a bridge over the Kansas River to connect the townships of Rossville, Shawnee County, and Maplehill, Wabaunsee County. Simeon C. Smith, County Clerk.

Atlanta, Ga.—The time for the opening of bids has been extended to Nov. 14 for the Pace's ferry bridge. E. B. Rosser, Chairman of Commissioners of Roads and Revenues, Fulton County. (Sept. 18, p. 679.)

Bloomfield, Ind.—Bids are wanted Oct. 6 by Green County Auditor Deckard for the buiding of a bridge in Grant Township.

Bridgewater, Pa.—The Town Council has passed the ordinance allowing the Beaver Valley to build a bridge at Leopard street.

Butler, Pa.—Several bridges were washed away by the bursting of the Boydstown dam.

Canal Dover, Ohio.—The Commissioners of Tuscarawas County are preparing plans for the building of a bridge over the Tuscarawas River in this city. It is to be a stone arch bridge to cost about $50,000.

Cathlamet, Wash.—Bids are wanted Oct. 5 by the County Commissioners for building a new bridge, with concrete pier, over Shanokawa Creek and removing the present structure.

Conshohocken, Pa.—Local reports state a contract has been awarded by the County Commissioners for repairing Matson ford bridge over the Schuylkill River, including the building of four piers, to Deschant & Co., at about $30,000.

Danville, Ill.—A bridge to cost about $30,000, it is reported, will be built at this place by joint account of the county, the township and the city.

Delphi, Ind.—Bids are wanted Oct. 6 by James C. Smock, Carroll County Auditor, for a bridge over Bachelor Run.

Des Moines, Iowa.—The Board of Public Works, which is asking bids for a steel bridge on East Sixth street, to cost about $65,000, may withdraw tenders for these bids and ask new ones for a concrete arch bridge at a cost of about $15,000 additional.

East Toronto, Ont.—The Council is willing to pay a portion of the expense of building a new steel bridge at Main street, which is to carry electric cars.

Elba, N. Y.—A new iron bridge will be built on the new swamp road; also 11 bridges at this place and Barre.

Elk River, Minn.—Commissioners of Wright and Sherburne Counties and the town boards of Elk River and Otsego will ask bids for the building of a bridge over the Mississippi River between Elk River and Otsego.

Fredericton, N. B.—The New Brunswick Government are asking bids up to October 12 for rebuilding Arseneau bridge in Gloucester County.

Hannibal, Mo.—Bids are wanted Oct. 5 by Chas. F. Shepherd, City Clerk, for building two concrete abutments for the Third street bridge.

Harrisburg, Pa.—A movement is on foot for the erection of an overhead bridge over the Cumberland Valley tracks at Second and Mulberry streets.

Houston, Texas.—The City Council will be asked to pay $22,500 towards the building of a new steel bridge over the bayou connecting McKee and Gable streets, which the county will build at a cost of about $57,000.

Indianapolis, Ind.—The ordinance appropriating $65,000 for the building of a bridge at Northwest avenue has been signed by the Mayor.

Bids are wanted Oct. 5 by Harold C. Megrew, Chairman of the Board of Public Works, for building a concrete steel arch bridge over the canal at Washington street.

Kansas City, Kan.—The bids opened Sept. 15 for building the viaduct over the tracks of the Union Pacific and the Chicago, Rock Island & Pacific at Tenth street were as follows: St. Paul Foundry Company, St. Paul, Minn., $127,000; A. J. Tullock, Leavenworth, $127,000; Canton Bridge Company, Canton, Ohio, $124,800; Midland Bridge Company, Kansas City, Mo., $119,624; Minneapolis Steel Company, Minneapolis, Minn., $119,850; John Galligan, Falls City, Neb., $113,270; American Bridge Company, New York, $110,000; Clinton Bridge Company, Clinton, Iowa, $109,199; J. H. Sparks, St. Joseph, Mo., $108,777, and A. M. Blodgett, Kansas City, Mo., who is reported to have the contract, $105,274. (Sept. 4, p. 641.)

The County Commissioners of Wyandotte County have awarded a contract for the building of the steel bridge at Kansas avenue to A. McLouth, of McLouth, Kan., at $88,500, they being the lowest of 21 bidders.

Milwaukee, Wis.—The city may soon build a bridge over the Milwaukee River at West Water street which, according to the plans, is to be a bascule bridge to cost about $96,000. An additional bridge, which is to be a single turn-table draw, may also be built by the C., M. & St. P. Ry. The plans for both these bridges have been approved by the War Department. Chas. J. Poetsch, City Engineer.

Montreal, Que.—Application is being made by the Westminster Bridge Company to the Dominion Parliament for incorporation, for the purpose of acquiring from the British Columbia Government the bridge now building over the Fraser River at New Westminster; also to build bridges. The application is made by John Hendry, President of the Vancouver, Westminster, Yukon & Western Ry., the road over which the Great Northern will have an entrance into Vancouver to connect with its ferry to Victoria, operated by the Victoria Terminal Railway & Ferry Company.

New York, N. Y.—The following ordinances have been approved by the Mayor for building bridges: $100,000 for approach to Willis avenue bridge; $150,000 for the Madison avenue bridge over Harlem River; $325,000 for buying land and building the bridge over Flushing Creek between Jackson avenue, Newtown, and Broadway, Flushing, in Queens Borough.

Only one bid was received Sept. 24 by Commissioner Lindenthal for the steel superstructure of the Blackwell's Island bridge over the East River, that of the Pennsylvania Steel Company, which is the company that did the work on the Williamsburg bridge. The Commissioner, in view of the fact that only one bid was submitted, which he considers excessive, may soon ask for new bids for this work.

Omaha, Neb.—The Union Pacific, local reports say, will build a viaduct about 800 ft. long from the foot of Capitol avenue to its shops.

Peninsula, Ohio.—Bids are wanted Oct. 10, by the County Commissioners, for the building of an arch bridge at this place.

Pittsburg, Pa.—The Pennsylvania Railroad, it is reported, has plans ready for the rebuilding of many of the bridges along the line of the Western Pennsylvania division to accommodate heavier rolling stock and additional tracks.

Princeton, Ind.—Bids are wanted Oct. 8 by Jonothan W. Phillips, Chairman of the Board of County Commissioners, for building two iron bridges.

Rockford, Ill.—Plans have been submitted for a new bridge at Morgan street which call for a truss bridge to cost $56,000, or a girder bridge at $60,000. The City Engineer will probably recommend a concrete bridge of three spans.

Reading, Pa.—The County Commissioners recommend that the county build a bridge over Saucony Creek near Fleetwood road.

The Philadelphia & Reading has submitted plans for the city's approval for the building of a steel bridge at Front street to cost about $25,000.

Redwood City, Cal.—Bids are wanted Oct. 5, by H. W. Schaberg, County Clerk, for a combination steel and concrete bridge to replace a wooden structure over a creek on main county road near Burlingame.

San Francisco, Cal.—The Southern Pacific is building a through pin connected steel bridge over the Salinas River on the Monterey branch between Castroville, Cal., and Monterey, Cal. The bridge will have four 144 ft. spans, concrete piers and abutments, and cost $80,000.

San Luis Obispo, Cal.—A stone or steel and concrete bridge is to be built on Santa Rosa street across Steiner Creek.

Sioux Falls, S. Dak.—The Willmar & Sioux Falls will replace the present wooden bridge over the Sioux River with a steel structure of 350 ft. span.

South Bend, Ind.—Bids are wanted Oct. 6 by John M. Brown, County Auditor, for two iron bridges, one over Miller ditch and the other over Yellowbank Creek.

Taloga, Okla. T.—The Dewey County Commissioners will build a bridge over the South Canadian River.

Washington, Iowa.—The county will build a new steel bridge 20 ft. wide over Crooked Creek on Sigourney road.

Williamstown, Ky.—Grant County will vote next month on an appropriation of $13,000 for a bridge over Eagle Creek. R. L. Kuman, County Clerk.

Youngstown, Ohio.—The Youngstown & Sharon Railway Co. is asking bids for a bridge or tunnel to be built over or under the Pennsylvania, near the town of Columbiana, to avoid a grade crossing over the tracks of this company. The cost of the work is estimated at $20,000.

Other Structures.

Dallas, Texas.—The Metropolitan Street Ry. Co., it is reported, will build a large brick car barn about 300 ft. x 450 ft.

East Moline, Ill.—The Rock Island, it is reported, is preparing plans for the building of large locomotive repair and construction shops at East Moline.

Fairview, Pa.—The Pennsylvania, it is reported, has plans ready for the building of shops at Fairview, to cost about $500,000. Bids are asked until Oct. 5. Chas. Gilpil and Roydhouse, Arey & Co., Philadelphia, contractors, are preparing estimates.

Gomez Palacio, State of Durango, Mexico.—The Mexican Central will build a number of new structures in Gomez Palacio, in connection with the removal to this place of its division shops from Jiminez.

Greenville, N. J.—Henry Steers, of New York, has a contract from the Pennsylvania to build a pier 1,000 ft. long and 200 ft. wide at Greenville.

Harrisburg, Pa.—Bids are being asked by the Pennsylvania for the building of the following shops at Enola, across the river from this city, where there is to be a large new freight yard: One material building 522 ft. x 60 ft.; smith shop, 55 ft. 4 in. x 50 ft.; storeroom, 237 ft. 6 in. x 60 ft.; men's room, 116 ft. 6 in. x 60 ft.; lavatory, 69 ft. 6 in. x 60 ft.; planing room, 40 ft. x 60 ft.; machine shop, 80 ft. x 60 ft.; fan house, 60 ft. x 45 ft.; office, 140 ft. x 50 ft.; bunk house, 100 ft. x 40 ft.; oil-house, 25 ft. x 50 ft. The company will also build large shops between Enola and Glen Loch.

Helena, La.—The Memphis, Helena & Louisiana has bought land and will build shops, roundhouse and other buildings for its Southern Division.

Hillsboro, Texas.—The Trinity & Brazos Valley is preparing plans for shops at Hillsboro.

New York, N. Y.—Bids are wanted Dec. 15, by A. J. County, Secretary of the Pennsylvania, New Jersey & New York, at 85 Cedar street, New York, N. Y., for the construction of various sections of tunnels under Bergen Hill and North River within the State of New Jersey, as advertised in the *Railroad Gazette*.

Separate bids are wanted Dec. 15, by Robert H. Groff, Secretary of the Pennsylvania, New York & Long Island, at 85 Cedar street, New York, for the construction of various sections of tunnels under 32d street, Manhattan, and North River, within the State of New York, and at a point near Seventh avenue, in 32d and 33d streets eastward under Manhattan, East River and Long Island City, to a point north of Borden avenue in Long Island City, as advertised in the *Railroad Gazette*.

Philadelphia, Pa.—The Pintsch Compressing Company is building a gas compressing plant consisting of a brick building, 40 ft. x 100 ft., for which contract has been awarded to Chas. Gilpin, Philadelphia.

Pittsburg, Pa.—The Pennsylvania, news reports state, has plans ready for the building of many new passenger and freight houses along the line of the Western Pennsylvania division.

The Wabash has awarded a contract for the building of a large train shed and the approach to the Monongahela River bridge to the Pennsylvania Steel Co.

Providence, R. I.—The architects for the new Government building, which is to cost $1,000,000, are Clark & Hall.

Reading, Pa.—The Philadelphia & Reading is asking bids for extensions to its car shops at Reading.

Vancouver, B. C.—The proposed wharf construction by the Canadian Pacific at this place will consist of five piers each 650 ft. long by 175 ft. wide, with two warehouses on each.

Winnipeg, Man.—Announcement has been made that plans for an extensive station and hotel combined to be built by the Canadian Pacific have finally been passed by the Board of Directors, and that work will be commenced early next spring. The estimated cost is $2,000,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Allegheny R. R.—A charter has been granted this company in West Virginia to build a railroad from Davis, Tucker County, east to a point on the Stony River, in Grant County, 15 miles. W. J. Armstrong, Philadelphia; A. R. Stalings, Davis, W. Va., and others are interested.

Amarillo, Plainview & Southern.—An officer is quoted as saying that grading will be begun in 30 days on this proposed railroad from Amarillo, Texas, south through Tulia and Plainview to Lubbock, 115 miles. J. M. Donahue, Canyon City, Texas, is President, and R. P. Smith, Plainview, Texas, is Secretary. (Sept. 11, p. 659.)

Avondale & Cleveland.—Articles of incorporation have been filed by this company to build and operate a railroad from Avondale, Randolph County, W. Va., northeast to Cleveland, Webster County, 110 miles. J. J. Mead, Pittsburg, Pa.; C. A. Rouse, O. E. Swartz and A. K. Hugell, Clarksburg, W. Va., are incorporators.

Bakersfield & Ventura.—Press reports state that this company will shortly begin work on its proposed line from Los Angeles through Bakersfield to San Francisco. H. H. Russell, J. M. Herbert, of Los Angeles, Cal.; A. M. Sanford, Denver, Colo., and J. M. Bursen, Ventura, Cal., are said to be interested. (March 13, p. 204.)

Beersville R. R.—Contract for grading this railroad from Beersville, Kent County, N. B., to a point on the Intercolonial, seven miles, has been let to J. C. Gilmore and Brown Bros., Moncton, N. B. The Imperial Coal Company, Beersville, is behind the project. According to the terms of the contract, the road must be completed by Jan. 1, 1904.

Bellingham Bay & British Columbia.—An officer writes that a line has been surveyed from Whatcom, Wash., east for a distance of 200 miles. Forty-five miles to Cornell have been completed and a five-mile branch to Lynden will be finished by Nov. 1. Surveys are now in progress between Cornell and Excelsior, nine miles. J. J. Donovan, Whatcom, Wash., is Chief Engineer. (Aug. 28, p. 624.)

Binghamton & Southern.—Final surveys are now being made for this proposed line from Binghamton, N. Y., southwest to Williamsport, Pa., 100 miles. A. B. Walter, Harrisburg, Pa., is President. (See Construction Supplement.)

Charleston, Champaign & Northern.—Articles of incorporation have been filed by this company in Illinois. It is proposed to build a railroad from Charleston, Ill., northeast to Homer, 40 miles. Connection will be made with the Wabash at Homer, and with the Cleveland, Cincinnati, Chicago & St. Louis, and the Toledo, St. Louis & Western at Charleston. W. R. Patton, W. F. Jenkins, J. B. Mitchell, C. L. Lee and others, of Charleston, Ill., are interested.

Chauncey, Athens & Amesville.—It is reported that surveys have been finished and work has been begun on the railroad which is to be built between Chauncey and Amesville. Talbot & Lindsay, Middleport, Ohio, are reported to have the contract for grading the first nine miles.

Chesterfield & Lancaster.—An officer writes that surveys are now being made for an extension from the present terminus of the road at Ruby, S. C., southwest to Plains, 15 miles, but that no grading will be done for the present. A. H. Page, Cheraw, S. C., is General Manager, and W. F. Stevens, Chief Engineer. (Sept. 18, p. 680.)

Chicago, Milwaukee & St. Paul.—The extension from Woonsocket, S. Dak., west to Wessington Springs, 15 miles, has been completed and regular train service will be begun Oct. 4. (May 29, p. 384.)

Chicago, Rock Island & Pacific.—The newspapers say that surveys are now being made for a proposed new short line from Trenton, Mo., southwest to Kansas City in place of the present line, which runs to Cameron, connection being made from there to Kansas City over the C., B. & Q. It is stated that the new line will be built directly south from Jamesport and will parallel the Chicago, Milwaukee & St. Paul, crossing the Hannibal & St. Joseph at Hannibal, and the Atchison, Topeka & Santa Fe at Converse.

Choctaw, Oklahoma & Gulf.—Work has been resumed on the extension from Amarillo, Texas, west to Tucumcari, N. Mex., and grading is now in progress at both ends of the line. The W. R. Stubbs Contracting Company has the contract. (Sept. 18, p. 680.)

CHOCTAW, OKLAHOMA & GULF.—Surveys are now being made on the main line of this company between Little Rock, Ark., and Oklahoma City. It is stated that these surveys are being made with a view to reducing grades and curves between these points.

CLEARFIELD SOUTHERN.—Bids will be received until Oct. 3, by H. Fernstrom, Chief Engineer, New York Central & Hudson River, for the building up to sub-grade of a branch line four miles long between Irvona and Potts Run Junction, Clearfield County, Pa. The Clearfield Southern runs between Porters and Potts Run Junction, Pa., 13 miles, and was recently bought by the New York Central. It is operated as a part of the Pennsylvania Division.

COAST-KOOTENAY.—Work has been begun on this railroad in British Columbia. McLean Bros., Vancouver, B. C., are the contractors. The proposed route is from Vancouver through New Westminster, and thence east through the Chilliwack Valley to Hope, and thence in a southeasterly direction to Princeton. A charter was granted this company three years ago, but no work has been done up to this present time. Wm. E. Oliver, Victoria, B. C., is said to be interested. (See Construction Supplement.)

COLCHESTER R. R.—Surveys have been finished for a railroad four miles long from Debert, N. S., a point on the Intercolonial, to the Debert coal mines. R. Archibald, Debert, N. S., is said to be interested.

DELAWARE & HUDSON.—This company is about to build a branch 5 miles long on its Adirondack Division from Thurman Station, N. Y., to Warrensburg. Surveys are now in progress and it is stated that work will shortly be begun. The new line will be used to carry the large amount of freight which comes from the mills at Warrensburg.

DENTON, DECATUR & WESTERN.—Location surveys are reported finished between Denton, Texas, and Decatur. The proposed route is from Denton to Roswell, N. Mex., with a branch east to Mansfield, La. It is stated that contracts for grading the first portion of the line will be let within 30 days. M. J. Healy is Vice-President and General Manager, with headquarters at Decatur. W. H. Sisson, St. Louis, Mo., is President, and J. P. McCarthy, Lufkin, Texas, is Chief Engineer. (Sept. 18, p. 680.)

DES MOINES, IOWA FALLS & NORTHERN.—The Globe Construction Company has finished ballasting the section of this line between Cambridge and Des Moines, Iowa, 24 miles. The entire line will probably be opened for traffic by the end of the year. The route is from Des Moines to Iowa Falls, 76 miles, passing through the towns of Enterprise, Elkhart, Cambridge, Shipley and Buckeye. E. E. Ellsworth, Iowa Falls, is President. (July 31, p. 562.)

EASTERN OF ALABAMA (LOUISVILLE & NASHVILLE).—Press reports state that this company will build an extension from its present terminus at Pyrites, Clay County, Ala., southeast to Roanoke, 35 miles. Connection will be made with the Central of Georgia at Roanoke. T. H. Smith, Talladega, Ala., is President.

EASTERN WISCONSIN RAILWAY & LIGHT.—Incorporation has been granted this company in Wisconsin, with power to build an electric line from Oshkosh south to Fond du Lac, 20 miles, paralleling the Chicago & North Western and the Wisconsin Central. The headquarters of the company will be at Fond du Lac, Wis. F. B. Hoskins, Benjamin Wild and Leander Choate are incorporators.

FRANKLIN & CLEARFIELD.—The final surveys for this line are now being made from Franklin, Pa., east to Clearfield, 40 miles. The surveys will probably be finished by the end of the year and contracts for grading will be let early in January. Charles Miller, Meadville, Pa., is President, and the directors include W. H. Newman, of the New York Central, and T. J. Jerome, of the Lake Shore & Michigan Southern. (April 3, p. 255.)

GREAT NORTHERN.—Surveys have been completed for a branch line from Wenatchee, Wash., northeast to Republic, 105 miles. Contracts for grading will be let in the early spring. (See Construction Supplement.)

GULF & INTERSTATE.—This road was opened for traffic on Sept. 24, between Beaumont, Texas, and Bolivar Point, 73 miles. The road was partially destroyed during the severe storm along the coast of Texas in 1901. L. L. Featherstone is General Superintendent, with headquarters at Beaumont. (July 28, p. 548.)

GULF, BEAUMONT & KANSAS CITY.—An officer writes that grading has been completed on the extension from St. Augustine north to Center, Shelby County, Texas, 19½ miles. The maximum grade is .7 per cent., and maximum curvature 3 deg. There are no important bridges or trestles. L. J. Smith, Kansas City, Mo., is the contractor. (See Construction Supplement.)

GULF, CALCASIEU & NORTHERN.—Surveys have been finished for this railroad which is to be built from Lake Charles, La., north to Natchitoches, 100 miles. Contracts for grading will be let in the spring. The work will be light, with maximum grades of .8 per cent., and maximum curvature of 4 deg. H. B. Milligan, Lake Charles, is President, and J. T. Shutts, Chief Engineer. (July 10, p. 520.)

HAYNEVILLE R. R.—Surveys have been completed and work begun on this railroad from Hayneville, Ala., east to Morganville, 10 miles. Grading is being done by the company's forces. Willis Breiner, Hayneville, Ala., is President. (Sept. 11, p. 660.)

INDIANAPOLIS SOUTHERN.—Grading has been begun between Indianapolis and Bloomington, and it is stated that this part of the road will be built by Jan. 1. The line will eventually be extended to Sullivan, Ind., 140 miles from Indianapolis. The Southern Construction & Equipment Company has the contract for building the road. T. H. Hazelrigg, Indianapolis, Ind., is Chief Engineer. (Sept. 4, p. 642.)

JACKSONVILLE & CONCORD.—This company has been incorporated to build a railroad from Jacksonville, Morgan County, Ill., northwest to a point near Concord, nine miles. Rights of way are now being secured and it is said that surveys will be made at once. Connection will be made with the Chicago, Burlington & Quincy at Concord. C. V. Carpenter, Downer's Grove, Ill.; J. A. Connell and J. M. Deering, La Grange, Ill., are incorporators.

KNOXVILLE, LA FOLLETTE & JELLICO.—Contract for building the Second Creek spur of this road has been let to Edington, Groner & Griffitt, Knoxville, Tenn., who will sub-let a good part of the work.

LOUISIANA SUGAR BELT.—Articles of incorporation have been filed by this company in Louisiana. It is proposed to build from Thibodaux, La., east to New Orleans, 45 miles, with a branch to Grand Isle. F. B. Merrill, formerly President of the Mobile, Jackson & Kansas City, is President of the new company, with headquarters at Mobile, Ala. J. F. Denechaud, New Orleans, is Vice-President, and E. Constantin, Lockport, La., is Treasurer.

MEMPHIS, HELENA & LOUISIANA (MISSOURI PACIFIC).—Grading is practically completed on this road from Trippe Junction, Ark., to Concordia, La., 145 miles.

MEXICAN INTERNATIONAL.—Press reports state that this company will shortly build a branch line from Catalina, in the State of Durango, Mexico, south to Chalchihuites, 80 miles. Preliminary surveys are now in progress.

MEXICAN ROADS.—President Porfirio Diaz, in his recent message to the Mexican Congress, gave the following review of the amount of railroad construction completed in Mexico during the past year: "The increase of the railroad systems during past fiscal year has been 268 miles, of which 105 miles have been credited to the National R. R. of Mexico on its new line between Huehuetoca and Gozalez; 43 miles to the Kansas City, Mexico & Orient; 48 miles to the Mexican Central on its Panuco and San Pedro divisions; eight miles to the Interoceanic, which has completed its line from Cuautala to Chietla, and the remainder to smaller lines.

MISSOURI ROADS.—The newspapers say that surveys are now being made for a railroad from Joplin through Scott, Neosho, Granby, Pierce City, Carthage, Webb and Carterville. W. S. Brawner and Charles Cundiff, St. Louis, Mo., are said to be interested.

NICHOLAS SHORT LINE.—An officer writes that the proposed route of this line is from Belva, W. Va., six miles up the Gauley River to Laurel Creek. Contracts for grading will be let within 30 days. There is considerable heavy work. There will be one trestle 30 ft. high and 200 ft. long. C. C. Sharp, Gauley Bridge, W. Va., is Chief Engineer. (Sept. 18, p. 680.)

NORFOLK & WESTERN.—It is officially announced that the press reports stating that this company will build a temporary line around the Craigen tunnel, Va., are false. The fire which has been burning in the tunnel for several days has been extinguished and it is stated that the line will soon be in operation again.

OKLAHOMA CITY & NORTHWESTERN.—Surveys have been completed on this proposed line from Coalgate, Okla. T., northwest to Carmen, 110 miles. It is proposed to extend the line eventually to Denver, Colo. President C. J. Jones, Oklahoma City, says that a contract for building part of this road will be let about Oct. 15. The St. Louis & San Francisco is reported to be behind the project.

PENNSYLVANIA.—According to press reports, this company will invite bids early in October for building its tunnel under the North River and its terminal in New York City. President A. J. Cassatt has approved the specifications for some of the heavier work, and unless labor troubles intervene, work will probably be begun this fall.

RIO GRANDE, SIERRA MADRE & PACIFIC.—It is reported that arrangements are now being made for an extension of this railroad from its present terminus at Terrazas to a connection with the Kansas City, Mexico & Orient, 177 miles.

RUSK & SOUTHWESTERN.—It is reported that this company, which was recently incorporated in Texas, has failed to lease from the State of Texas, the railroad which runs from Rusk southwest a distance of 20 miles. It is stated that the company will soon begin work on a parallel line. W. H. Knox, S. P. Wilson and others, of Rusk, are interested. (Sept. 11, p. 660.)

SOUTHERN.—This company has recently put in use 15 miles of second track between Alexandria, Va., and Sideburn. (May 8, p. 336.)

A line four miles long in Shelby County, Ala., has been authorized by the board of directors. It will extend from a point on the Brierfield, Blocton & Birmingham in a westerly direction along Savage creek and the Cahaba River to the coal mines of the Bessemer Land & Improvement Company in Shelby County.

SOUTHERN PACIFIC.—Reports state that only two miles of the trestle work on the Lucin cut-off across Great Salt Lake remain to be built, and that this part of the work will probably be finished by Nov. 1.

WISCONSIN ROADS.—The Foster-Latimer Lumber Company will build a steam logging road 29 miles long from its mills at Mellen, Wis., into timber lands. H. J. Latimer is Chief Engineer, and Geo. E. Foster is President.

GENERAL RAILROAD NEWS.

BUFFALO & SUSQUEHANNA RY.—In addition to the usual quarterly dividend of 1¼ per cent. which has been declared on the common stock of the Buffalo & Susquehanna Ry. Co., the stockholders of the Buffalo & Susquehanna Ry. Co. will receive a cash payment equivalent to five-eighths of one per cent. on the par value of their holdings. This payment is made under a special arrangement pending the completion of the railway company's purchase of the common stock of the railroad.

CENTRAL OF NEW JERSEY.—The gross earnings of this company for the year ending June 30, 1903, were $15,672,566. Operating expenses were $10,321,825, leaving net earnings of $5,350,740. Income from other investments was $1,142,178, making a total net income of $6,492,919. From this amount was deducted for taxes, interest and dividends $7,402,377, leaving a deficit of $908,558. With regard to this deficit, President Baer says in part: "During the six months from May to October, 1902, there was a strike of the miners in the anthracite regions which not only resulted in a heavy loss of revenue to the railroad company from loss of tonnage, but also brought about an abnormal increase in the cost of the company's fuel, both anthracite and bituminous. This increase in cost of fuel and wages, together with several freshets in the Lehigh Valley in the early spring which resulted in severe damage to the roadbed and the loss of several bridges, has brought about a considerable increase in the cost of operating." The report shows that there is a surplus of $442,421 for the first six months of 1903.

CHICAGO, MILWAUKEE & ST. PAUL.—This company has recently purchased a part of the Marinette, Tomahawk & Western. This is a logging road and runs from Tomahawk, Wis., to Harrison, 32 miles, with a branch from Tomahawk to Gleason, 22 miles. The part bought by the Chicago, Milwaukee & St. Paul runs from a point on the southern line of Lincoln County to a point within four miles of Merrill. An extension will be built from this latter point to Merrill, to connect with the C., M. & St. P.

CHICAGO, ROCK ISLAND & PACIFIC.—See Seaboard Air Line below.

DENVER & RIO GRANDE.—At the next meeting of the stockholders of this company an increase in the capital stock from $44,400,000 to $50,000,000 will be voted upon. This increase is to pay for the Crystal River R. R., recently acquired by the Denver & Rio Grande. The Crystal River road runs from Redstone, Colo., to Coal Basin, 12 miles, and from Carbondale to Placita, 20 miles. (Sept. 11, p. 660.)

DENVER, ENID & GULF.—A mortgage for $2,600,000 has been filed by this company with the Mississippi Valley Trust Company of St. Louis, as trustee, to secure 5 per cent. 50-year gold bonds which are to be issued, at not exceeding $20,000 a mile, on the extension from Guthrie northwest through Enid and the Counties of Grand and Woods to the Kansas State line, 130 miles. The line was recently opened between Guthrie and Enid.

GEORGIA SOUTHERN & FLORIDA.—Gross earnings of this company for the year ending June 30 were $1,635,191, an increase of $384,316. Operating expenses were $1,234,402, an increase of $278,496, leaving an increase in net earnings of $105,819. The average miles operated during 1903 were 358 as against 285 in 1902. This increase in mileage was due to the acquisition of the Atlantic, Valdosta & Western.

ILLINOIS CENTRAL.—Gross earnings of this company for the fiscal year ending June 30, 1903, were $45,186,076, an increase of $4,365,046. Operating expenses were $31,697,955, an increase of $3,683,614, leaving an increase in net earnings of $681,431. The report states that the second track has been completed between Chicago, Ill., and Fulton, Ky., 406 miles, with the exception of the Cairo bridge. During the year 63 new locomotives and 11,102 freight cars were bought.

INTERBOROUGH RAPID TRANSIT (NEW YORK CITY).—A newspaper report says that Chief Engineer Parsons has made the following statement about the Interborough Rapid Transit Company's line north of the post-office: "The work of excavation is 97 per cent. completed. Practically all of the 3 per cent. of uncompleted work is at Fort George and the Harlem River tunnel. South of 125th street 30 days will see all the excavation completed. Of the construction work, 75 per cent. is finished and fully three-fourths of the remaining 25 per cent. is well in hand. Had it not been for the strikes, we could have had trains running by Christmas, but it is probable that trains will be running, between One Hundred and Fourth St. and City Hall, in the early part of March, 1904."

MAINE CENTRAL.—The gross receipts of this company for the fiscal year ending June 30 were $6,734,484, an increase of $386,323. Of this increase, $142,320 was derived from passenger, mail and express transportation, $204,537 from freight, and $39,467 from miscellaneous sources. Operating expenses were $4,882,266, an increase of $330,006, which was due in large part to the higher cost of fuel, resulting from the coal strike, and to increases in wages. A charge of $75,000 was made to operating expenses to pay for the rebuilding of shops destroyed by fire at Portland. The sum of $493,796 was also charged to operating expenses for new cars and engines. Surplus income for the year amounted to $108,628, which was added to the contingent fund established last year. This fund now amounts to $170,659.

MASONTOWN & NEW SALEM.—The newspapers say that this railroad, which is owned by the United States Steel Corporation, has been leased to the Monongahela R. R. The Masontown & New Salem owns nine miles of track in Fayette County, Pa., connecting the three plants of the Southwest Connellsville Coke Company with the Baltimore & Ohio and Pennsylvania Railroads. The Monongahela R. R. is owned jointly by the Pennsylvania and the Pittsburg & Lake Erie. (July 3, p. 502.)

NASHVILLE, CHATTANOOGA & ST. LOUIS.—Gross earnings of this company for the fiscal year ending June 30 were $9,606,370, an increase of $1,613,839. Operating expenses were $6,995,604, an increase of $1,373,490, leaving an increase in net earnings of $240,349.

NATIONAL OF MEXICO.—The following details have been announced of the recent negotiations between Speyer & Co., New York, and the Mexican Government for the purchase of $5,000,000 4½ per cent. second debenture stock of the Interoceanic R. R. Co. The sale of these debentures was a part of the arrangement whereby the Mexican Government took over the newly created deferred stock of the National of Mexico. In order to reimburse itself for this and other securities purchased, the National of Mexico has decided to issue $8,300,000 of 5 per cent. two-year gold notes, dated Oct. 1, 1903. This issue will be secured by the following collateral: $5,192,000 of second debenture 4½ per cent. stock of the Interoceanic; $453,750 of the common shares of the Interoceanic; $51,000 of the 7 per cent. cumulative preferred stock of the Interoceanic; $3,000,000 of the first consolidated mortgage gold bonds of the Mexican International, and $1,050,000 of the first consolidated mortgage gold bonds of the National of Mexico. The company reserves the right to pay the notes at any time on 60 days' notice.

ST. LOUIS, BROWNSVILLE & MEXICO.—At a recent meeting of the stockholders of this company it was voted to increase the capital stock from $1,000,000 to $3,850,000, and to amend the charter so as to provide for an extension from Sinton, Texas, south to Houston and Brownsville, with branch lines from Chenango to Galveston, and from Kingsville to a point in Star County, a distance of 60 miles. C. C. Kleberg, Corpus Christi, Texas, is interested. (July 3, p. 502.)

SEABOARD AIR LINE.—It has been announced that the Chicago, Rock Island & Pacific has refused the offer of a controlling interest in the Seaboard Air Line. President John Skelton Williams, of the Seaboard, says: "There has been no change in the situation of the Seaboard Air Line as publicly announced at the time of the entrance of the Frisco-Rock Island interests into the board of directors and the board of voting trustees six weeks ago. The Seaboard System is an independent property and no change in its management or operation is contemplated."

SOUTHERN PACIFIC.—Announcement has been made by Edward Lauterbach, of New York, counsel to T. J. Taylor & Co., in their suit to prevent the Union Pacific from voting its holdings of the Southern Pacific stock, that negotiations for the settlement of the suit are now under way and that no protest will be made.